IRON DEFICIENCY ANAEMIA IN NEPAL: EPIDEMIOLOGY, DETERMINANTS, RESPONSE, GAPS AND RECOMMENDATIONS

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52nd master of Public health/International Course in Health Development
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A thesis submitted in partial fulfillment of the requirement for the degree of Master of Public Health

By
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Declaration:
Where other people's work has been used (either from a printed source, internet or any other source) this has been carefully acknowledged and referenced in accordance with departmental requirements.
The thesis **Iron Deficiency Anaemia in Nepal: Epidemiology, determinants, response, gaps and recommendations** is my own work.

Signature: 

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ABBREVIATIONS:

ANC	: Ante Natal Care
DHS	: Department of Health Services
ENA	: Essential Nutrition Action
FP	: Family Planning
FAO	: Food and Agriculture Organization
FCHV	: Female Community Health Volunteer
GDP	: Gross Domestic Product
HH	: Household
IDA	: Iron Deficiency Anaemia
IFA	: Iron Folic Acid
IMNMP	: Intensification of Maternal and Neonatal Micronutrient Program
IYCF	: Infant and Young Child Feeding
MDG	: Millennium Development Goal
MI	: Micronutrient Initiatives
MICS	: Multiple Indicator Cluster Survey
MNP	: Micro- Nutrient Powder
NMNSS	: Nepal Micronutrient Status Survey
MoHP	: Ministry of Health and Population
MSNP	: Multi Sector Nutrition Plan
NAGA	: Nutrition Assessment and Gap Analysis
NDHS	: Nepal Demographic and Health Survey
NDP	: National Deworming Program
NHP	: National Health Policy
NHRC	: Nepal Health Research Council
NHSP-IP	: Nepal Health Sector Program – Implementation Plan
ORC	: Outreach Clinic
PNC	: Post Natal Care
SHP	: Sub Health Post
SLC	: School Leaving Certificate
UNFPA	: United Nation's Population Fund
UNICEF	: United Nation Children's Fund
VDC	: Village Development Commiittee
WHO	: World Health Organization

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ABSTRACT:

Background: Maternal malnutrition is a common problem in Nepal. Iron deficiency anaemia (IDA) is one of the major public health problems in Nepal affecting more than one third of women in the reproductive age group. To address this problem, the government has formulated an IDA control strategy and has been implementing target based interventions. Despite several efforts, IDA is still a public health problem.

Objective: The main objective of the study is to explore and analyze the Iron Deficiency Anemia problem in Nepal by detailed study of its epidemiology, determinants, and various programs in response and to provide-evidence based recommendations to strengthen the program.

Study Method: The study is carried out doing a literature review of published and unpublished articles, journals, reports, etc. The conceptual framework is adapted and modified from the UNICEF conceptual framework for IDA

Findings: Pregnant, lactating women and adolescents are the most affected groups of reproductive age. IDA among this group can have serious and long term health consequences for themselves and also for their children. Deficiency of iron in the body causes IDA. Iron deficiency in the body is mainly caused by the inadequate intake of iron from diet and hookworm infestation. Other factors like Vitamin A, malaria, chronic diarrhoea, etc also play an important role in causing IDA.

Conclusion: Government response is not sufficient to address the IDA problem among women of reproductive age group. There is an issue of coverage and compliance of targeted intervention. Food based approach along with supplementation could be the good intervention to tackle IDA problem.

Recommendation: Government should continue the existing intervention and should focus on awareness of dietary modification/diversification at the household and community level. Nutritional interventions should be linked with other sectors like education, agriculture, livestock, livelihoods, etc. to have the desirable result.

Key Words: Anaemia, Iron deficiency, Iron deficiency anaemia, determinant of anaemia, program response, nutritional intervention in Nepal.

Word Count: 12277

INTRODUCTION:

Iron Deficiency Anaemia (IDA) is one of the major nutritional problems in the world affecting more than 1.2 billion people (1). Iron deficiency is the major cause of anaemia and it contributes almost half of the anaemia cases(2). In developing regions like southeast Asia and Africa, it is estimated that IDA was responsible for 183,000 deaths in 2013(1). IDA is responsible for 20% of maternal and perinatal mortality in developing countries(3). It is more common among pregnant women due to increases in physiological demand for iron(4). IDA has an adverse affect on health and the productive life of mother as well as growth and development of her child(3).

In Nepal, IDA is a serious public health problem(5) affecting all age groups of women. In Nepal, almost half (48%) of pregnant women are anaemic and more than one third of women of reproductive age are suffering from anaemia. Similarly, almost half (46%) of children below five years are anaemic. Instead of decreasing, the anaemia prevalence among pregnant women increased by 6% between 2006 and 2011.

Nutrition has been the priority program of Ministry of Health and Population (MoHP) which has been implementing many interventions to address IDA since late 1990s. Some of these interventions include supplementation of iron with folic acid tablets for pregnant women, deworming, vitamin A supplements, fortification, multi-micronutrient powders, and promotion and use of insecticide-treated mosquito nets. Despite these several effort, the result is not coming as expected. Therefore this study will focus understanding the gap in these IDA interventional processes by describing epidemiology and identifying and exploring the determinants, program responses and challenges.

I have been working as a Program Officer in a local Non-Government Organization. We are implementing the small scale fortification project in the rural VDC with an objective to improve the nutritional status of people (women and children) especially to reduce anaemia prevalence. In my working area, I found that fortification of staple food may reduce anaemia by almost 40%. At the national level the nutrition interventions seem to have failed to achieve similar results.

In Nepal, IDA is serious public health problem and one of the contributing factors for maternal and child mortality. Therefore, this has made me more curious and concerned about exploring IDA and its issues in Nepal which led me to carrying out this study.

This study is based on the literature reviews which describes the epidemiology of IDA, identifies and explores the determinants, analyses

program response by government and its gaps and finally provides the evidence based recommendation. IDA determinants are based on the adapted and modified conceptual framework of UNICEF 1990.

This thesis presents the results of the literature review, well structured and sequentially ordered in six different chapters as I. Background II, Problem Statement, Objectives and Methodology, III. Study results/findings. IV. Discussion, V. Conclusion and VI. Recommendations.

CHAPTER I: BACKGROUND INFORMATION OF NEPAL

1.1 Geography:

Nepal is a small nation situated in the south Asia. It is a landlocked country surrounded by India on three sides and by China in the north. It occupies only 0.03% and 0.3% of the total land area of world and Asia respectively. The country has an area of 1,47,181 square kilometers and stretches from east to west with a mean length of 885 kilometer and widens from north to south with a mean breadth of 193 kilometers. Topographically, the country is divided into three parts: Mountain, Hill and Terai (flat land). The climate varies in the country depending upon altitude which ranges from 70 meters to 8,848 meters(6).

Administratively, the country is divided into five development regions, 14 zones and 75 districts. Village Development Committees (VDC) is the small units within the district in rural area whereas municipalities are in urban areas. There are 191 municipalities and 3276 VDCs(7). Kathmandu is the capital of the country.

1.2 Political Situation:

Nepal adopted a new constitution on 20 September 2015 after a decade-long process of political wrangling and multi-stakeholder dialogues. The 240 years Monarchy was ended in Nepal by a first constitutional assembly on May 28, 2008. The new constitution provides for a federal system of government with seven states(8).

1.3 Demography:

According to the national census 2011, the population of Nepal is 26.4 million with an annual growth rate of 1.35%. The national population density is 180 people per square kilometer. More than half of the population (50.27%) lives in the Terai (flat) land. Nationally the average household size is 4.8 members. The population living in urban areas is 38.26%(7). The working age group population (15-59 years) accounts for more than half of the population, i.e. 57%.The sex ratio is 94 (94 males per 100 females).

Migration of large numbers of youth has become a prominent phenomenon and almost five million people are out of country for different purposes especially for jobs. This has impact on the total fertility rate of women which decreased to 2.52(9) in 2011 from 3.25(10) in 2001.

The life expectancy at birth is slightly higher (68 years) for females than males (65.5 years). More than one third of the household(HH) do not have a

toilet in their house and only 48% of households have access to a tap/piped water supply(9).

The literacy rate of the country is 65.9% with males (75.1%) and females (57.4%)(9).

1.4 Socio- Economic situation:

Nepal is a country with diverse culture, ethnicity and tradition. The majority(81%) of Nepalese people are Hindu (9) followed by Buddhism and other religions. The Nepali language is the official language of the country and more than hundred languages are spoken. Patriarchal society is inherent in Nepal except in some ethnical group. The social problems like domestic and sexual violence, girls trafficking, early and teenage marriage, dowry system etc., are still prevalent in the country.

Nepal is one of the poorest countries in the world. Agriculture is the main occupation and about 76% of households are involved in some kind of agricultural activities. The Nepal living standard Survey 2010/11 reveals that nearly 56% of households receive some sort of remittance and around one fourth of the population (25.16%) lives below the poverty lines. The Gross Domestic Product (GDP) of Nepal in the last five years from 2011 to 2015 remains stagnant at 4%(11) and the devastating earthquake in 2015 made it worse for country economy. Remittance is one of the most important sources of income in the country and estimated around 589 billion rupees sent by these populations yearly(12).

1.5 Country health system and situation:

Department of Health Services (DHS) under the leadership of the MoHP is accountable for delivering preventive, promotive and curative modern health services all over the country(13).

Health care services are provided by the public and private sector in Nepal. The private sector contributes 57% of total health expenditure and is limited to urban and district headquarters. Out of Pocket expenditure is 46% of total health expenditure.(14) Despite several efforts from the public and private sector, the health indicators are not showing good results. Nepal achieved only one target of the Millennium Development Goals (MDG); the goal of reducing maternal mortality.

Nepal is a facing triple burden of disease i.e. communicable, non-communicable, and re-emergence of eliminated diseases like small pox, leprosy, etc. Upper respiratory tract infection is the top reason for outpatient consultation while diarrhoea and gastroenteritis of presumed infection is the

top reason of morbidity in Nepal(13). Under five mortality and infant mortality is 54 and 46 per 1,000 live births(15).

Twenty-five percent of married women have unmet needs of family planning (FP). Almost half (49.7%) of married women are using modern methods of FP(15). Women receiving some Antenatal Care (ANC) and the recommended four or more visits with a skilled provider shows some improvement in the Nepal Multiple Indicator Cluster Survey (NMIC) which is 68% and 59% compare to NDHS report which is 60% and 50% respectively. Almost two in three births occur at home and only 36% of births are assisted by skilled health care providers(16).

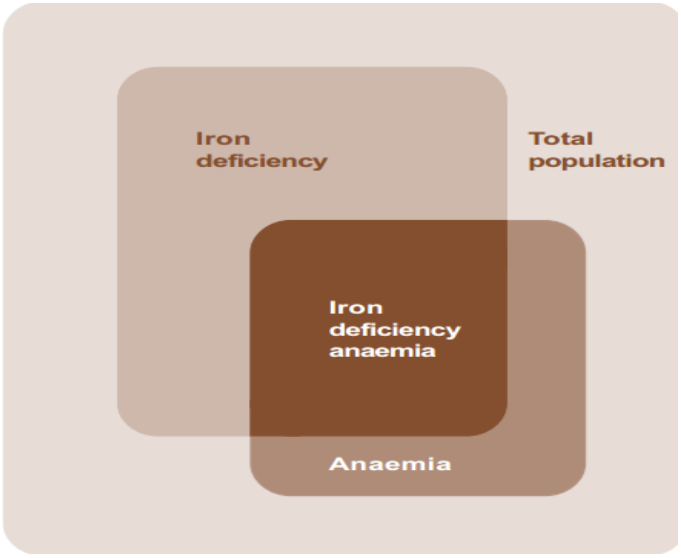
1.6 Nutritional situation:

Malnutrition is one of the major health problems in Nepal. Nepal is among the top ten countries in the world with the highest stunting prevalence. According to the NDHS 2011 survey, 41% of children under age of five are stunted, a form of chronic malnutrition and more prevalent in rural than urban areas. Similarly, wasting, a sign of acute malnutrition is found in 11% and 29% children under five years are underweight. Similarly, 18% maternal malnutrition is observed in the country and the trend of being overweight is increasing in urban areas. Nutritional anaemia is a serious public health problem in Nepal affecting all age groups of women and children below five years. A survey shows high prevalence of anaemia in pregnant women (48%), reproductive age group women (35%) and children less than five year(46%).(16)

CHAPTER II: PROBLEM STATEMENT, OBJECTIVES AND METHODOLOGY

2.1 Problem Statement:

WHO has defined Anemia as "a condition in which the number of red blood cells or their oxygen carrying capacity is insufficient to meet the physiologic needs, which vary by age, sex, altitude, smoking and pregnancy status". Iron deficiency is the most common cause of anemia in the world. The other conditions like deficiency of folate, vitamin B12 and vitamin A, chronic inflammation, parasitic infection, and inherited disorder also can lead to anemia. Generally the term anaemia, iron deficiency and iron deficiency anaemia are used interchangeably as anaemia is the most common indicator used to screen for iron deficiency(2).

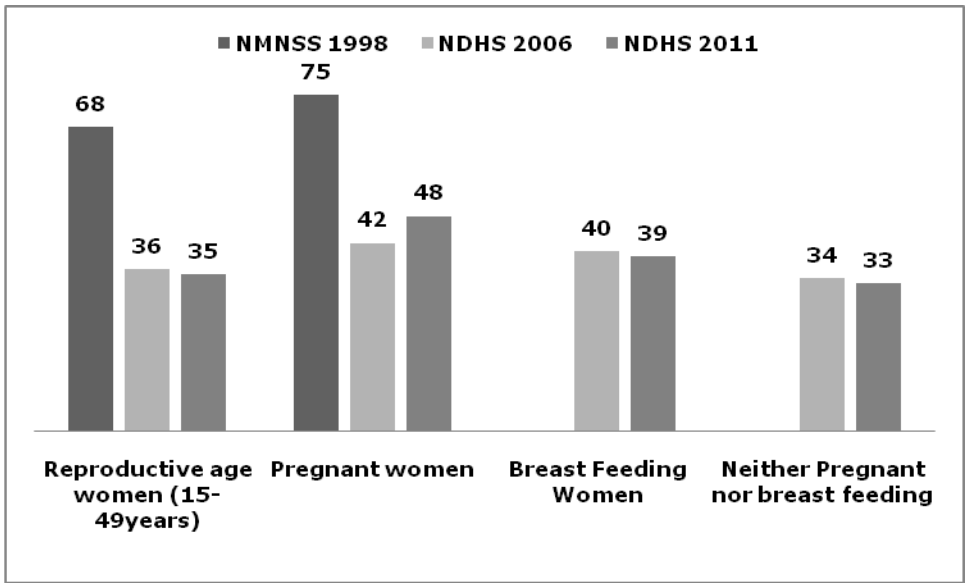


Source: WHO/UNICEF/UNU (2001**)**

Figure 1: Conceptual diagram of relationship between iron deficiency and anaemia in a hypothetical population

Iron deficiency is the most common cause of anaemia in world. IDA affects women more than men and contributes to half of a anaemia cases.(2) WHO estimates that worldwide, 42% of pregnant women, 30% of non pregnant women (15-50 years), 47% of preschool children(0-5 years) and 12.7% of men older than 15 years are anaemic(17). Globally 1.2 billion people are affected by IDA which caused 183,000 deaths in 2013(1,18). IDA is almost 5 times more common in developing countries than developed ones(19). In 2004, WHO estimated that among deaths due to IDA, 45% occurred in southeast Asia, 31% in Africa, 9% in Eastern Mediterranean, 7% in the Americas, 4% in the Western Pacific and 3% in Europe with 97% occurring in low and middle income countries(20).

Anaemia is a serious public health problem in Nepal. The problem of anemia came to notice in the late 1990s when the first nationwide survey started and till remains a public health issue. In 1998, the Nepal Micronutrient Status Survey(NMNSS) reported an anemia prevalence of 68%(21) among women of reproductive age. This prevalence had reduced to 36%(22) in the NDHS survey conducted in 2006. Later in 2011, the NDHS report showed only a decrease of 1% i.e., 35%, as illustrated in figure 2. Still more than one third of women of reproductive age are suffering from anaemia in Nepal.



Data Source: NMNSS 1998, NDHS 2006 and 2011

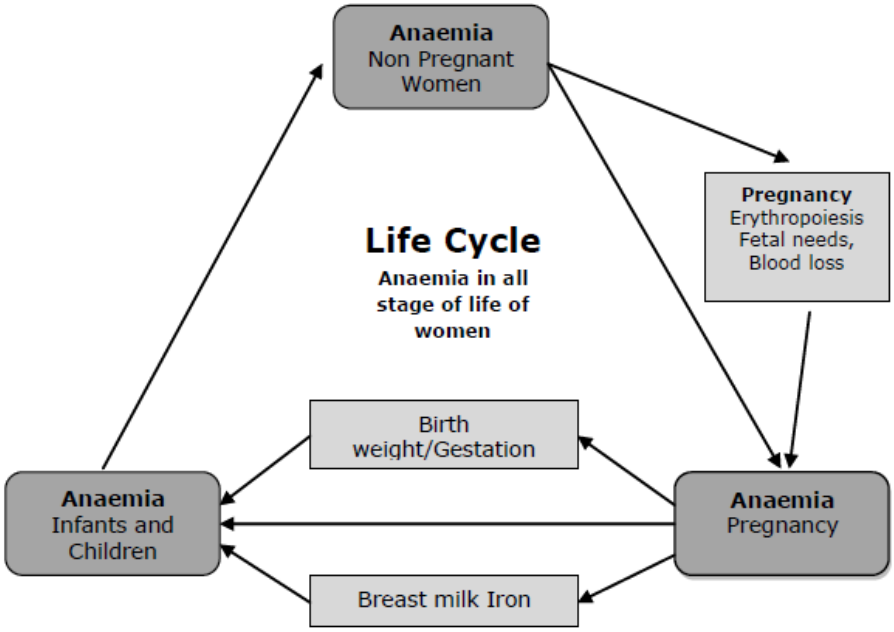
Figure 2: Situation of anaemia prevalence in Nepal

The prevalence of anaemia among pregnant women is even higher. The report of NMNSS in 1998 shows that three fourths, i.e. 75%(21) of pregnant women are suffering from anaemia. The prevalence was decreased to 42%(22) in 2006 but during the last NDHS survey in 2011, it increase by 6%, i.e. 48%(16). Compared to the 1998 NMNSS the prevalence of anaemia among pregnant women decreased from 75% to 48% which is good but still almost half of the pregnant women of Nepal are anaemic.

The prevalence of anaemia among lactating mothers is also high in Nepal. There was no change during the five year period from 2006 and 2011. The NDHS 2011 shows that 39%(16) of lactating mothers suffer from anaemia which is just a 1% reduction from NDHS 2006, i.e. 40%(22). Similarly in the case of women who were neither pregnant nor breast feeding, the anaemia prevalence hasn't changed much. Prevalence reduced by 1% from 34%(22) in NDHS 2006 to 33%(16) in NDHS 2011.

Anaemia is one of the nutrition problems in the country affecting more pregnant women than the women who are breastfeeding and women who are neither pregnant nor breast feeding. The high requirement for iron during fetus development could be the reason for the higher prevalence among pregnant women. In Nepal, anemia is observed more in rural areas (36%) than in urban areas (28%) and women from Terai region (42%) are more affected than the women from the mountain or hill zone (27%). Notable variations can be seen across Terai and other regions. Women living in Mid-western Terai and Eastern Terai sub regions are more anemic (49% and 45%, respectively) than women living in Central Mountain and Central hill sub regions (19% and 20%, respectively)(16).

Anemia is serious public health problem affecting larger proportion of women of reproductive age group. It hampers the development, performance, and productivity of women. Anaemia a form of malnutrition has a several health consequences from one generation to another as illustrated in figure 3.



Source: Adapted UNICEF Policy Review, UNICEF York, 1990

Figure 3: Anaemia in all stage of life.

Anaemia has many long term effects on health of women. Anemia is an underlying cause of maternal mortality, spontaneous abortions, premature births, and low birth weight. Iron deficiency accompanied by protein-energy malnutrition to a great extent affects infant and maternal health. Similarly, iron deficiency during pregnancy increases the risk of maternal mortality by

2.5 times, premature birth, and low birth weight along with several other complications. It is revealed in the study that the low birth weight is tripled and preterm delivery is more than double with IDA, but both cases are not increased with anemia from other causes. Forty per cent of all maternal perinatal deaths are linked to anaemia. Favorable pregnancy outcomes occur 30-45% less often in anaemic mothers(23). A study in the plains of Nepal revealed that 88% of cases of anemia among pregnant women were linked to iron deficiency (24).

Anaemia also effects productivity. The literature review shows that a 10% increase in hemoglobin levels is associated with 10 – 20 % increase in work output. It is supposed that women with anaemia are less likely to nurture and care for their children and less active in social activities(25). A study by the World bank in 2011, shows that the cost of the minerals and micronutrient deficiencies alone in Nepal contributes two to three percent of GDP lost annually and for each baby born with low birth weight (one of the cause of anaemia) that survives, the lifetime losses in earning are estimated at least US$ 500 leading to perpetuation of intergenerational poverty(26).

Nepal has reduced the prevalence of anaemia among women of reproductive age by almost half from 68%(21) in 1998 to 36%(22) in 2006. However, this reduction has ceased in the last decade. In the same period several interventions in response to IDA were implemented. These interventions include supplementation of iron with folic acid tablets for pregnant women from the second trimester to 45 days following delivery, deworming of pregnant women after completion of the first trimester, post-partum vitamin A supplements, and promotion of the use of insecticide-treated mosquito nets for pregnant women in malaria endemic areas(13).

Despite the several interventions to the reduce problem of anaemia, study results show no progress. Anaemia rates were higher among pregnant women(48%) and breastfeeding women(38%) than women who were neither pregnant nor breastfeeding(33%)(9). The prevalence of anaemia among adolescent girls has remained unchanged at around 39% over the last ten years.

In this situation there is a need to study of the existing strategy and intervention and find out the gap or reason for being falling to reduce the prevalence of IDA. Though it is challenging to the control the problem of anaemia in short period, with right intervention at the right time it is possible to reduce the severe consequences and complications associated. The findings of this study will help the officials working in the sector of nutrition especially in IDA to understand various determinants with current

responses and best practice intervention. This will help to understand policy and program gaps which ultimately help to strengthen the program.

2.2 Objective of the study:

2.2.1 General objective:

The main objective of the study is to explore and analyze the Iron Deficiency Anemia problem in Nepal by detailed study of its epidemiology, determinants and various programs in response. The study also aims to provide evidence based recommendations to strengthen the program.

2.2.2 Specific Objective:

- To describe the epidemiology of anaemia among female in Nepal.
- To explore the factors contributing to Anemia.
- To describe the current program response and identify the gap in tackling the Anemia problem.
- To identify and analyze the best practice interventions that is effective in reducing anaemia.
- To use the findings in order to formulate the evidence based recommendations to address the gap and strengthen the program.

2.3 Methodology

2.3.1 Search Strategy

The study is based on the review of the relevant published and un-published literature which includes reports, articles, policy, strategies, factsheets, books, journal, guidelines etc.

Google search engine was initially used to find the official websites of the relevant organization like World Health Organization (WHO), MoHP-Nepal, DoHS, UNICEF, Micronutrient Initiatives (MI), NHRC, Central Bureau of Statistics, and UNFPA. From these web addresses the required Information and data were retrieved.

Database like PubMed, VU E library and search engines like Google, Google Scholar and different websites like www.sciencedirect.com, www.nutrition.org, were used to search the published articles. To limit the number of searched articles, key words related to the study were used. Key words like Nutrition status in Nepal, Iron Deficiency Anemia in Nepal, epidemiology and situation of IDA in Nepal, determinant, direct indirect and under lying causes, intervention, framework related to IDA were used alone and in combination.

The listed articles were further screened through abstract reading. Bibliographies of relevant articles were also used as means to search other related articles cited.

Table 1: Literature search strategy

Sources	Key words use to search literature			
	Objective 1	Objective 2	Objective 3	Objective 4
Central Bureau of Statistics Nepal website MOHP website Department of Health Services Website Vu e-library UNFPA website WHO website PubMed Google Scholar	Epidemiology of Anaemia in world, Epidemiology of Anaemia in Nepal. Epidemiology of IDA in Nepal. IDA distribution in Nepal. Situation of IDA in Nepal, prevalence	Determinant of IDA. Causes, factor contributing IDA Risk, Basic cause, underlying cause, immediate cause, deworming and IDA, Iron deficiency, Inadequate iron intake, inadequate care, inhibitor – Iron absorption, available iron	Nutrition program, nutrition policy, Strategy, Food fortification, Food based approach, IFA supplementation, National Protocol, Micro-nutrient powder, Vitamin A supplementation, deworming, malaria, FP, golden 1000 days	WHO recommendation, best intervention, best practice, successful intervention

2.3.2 Limitation of research.

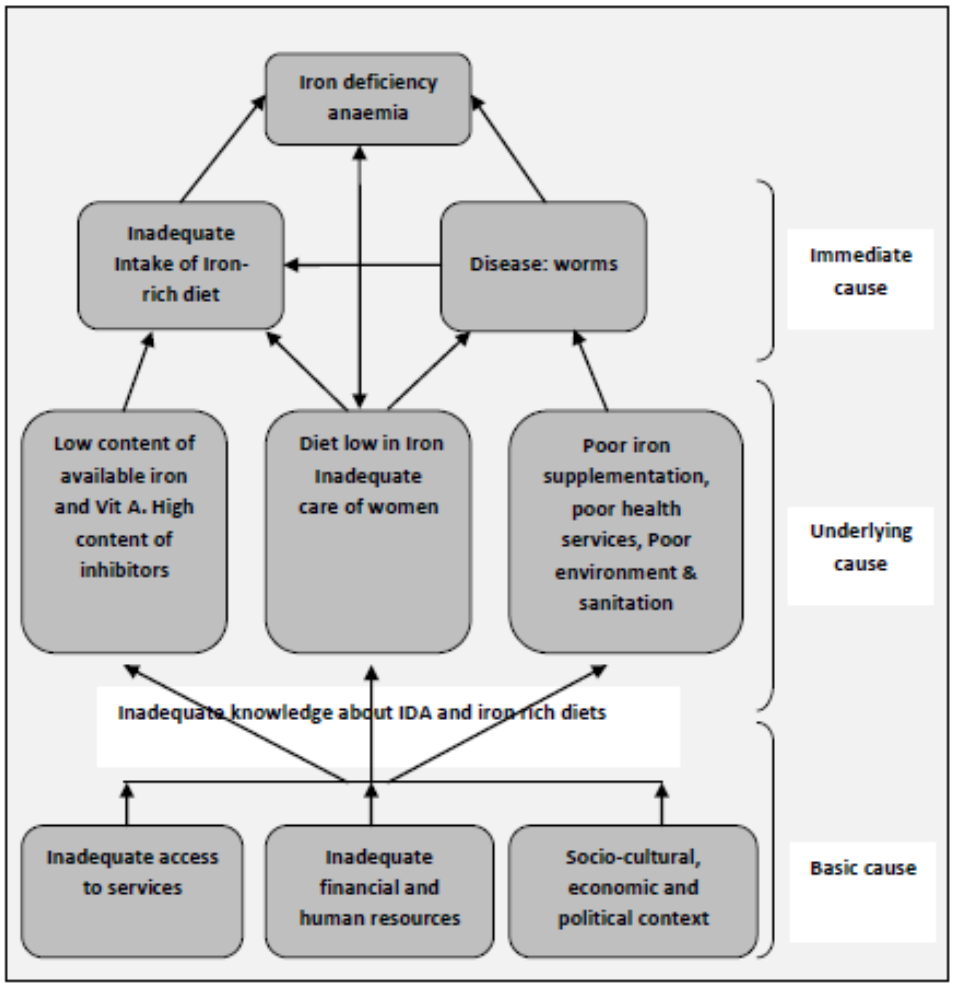
The free articles published in English language and easily accessible on online are reviewed. Other articles which are in local language and articles that require payment were excluded.

In Nepal, NDHS is only national level reliable source of information related to IDA and recent data are not available. The NDHS report only includes data and has no information on statistical significance. There are other studies that are limited to districts and certain other geographic areas. This might influence generalization of the results in the current context. Nowadays online is the source of information for most topics and it is unlikely that researchers would not share their paper online with an English version.

2.3.3 Conceptual framework

Conceptual framework designed by the UNICEF in the year 1990(27) was adopted and modified in this study for describing different factors/causes of IDA. This study is about the IDA among women of reproductive age so framework has been modified accordingly. This framework has been largely accepted as the best way to understand the different causality of IDA at different level and also suitable in Nepal context. It identifies three levels of causality of IDA.

Immediate causes operate at the individual level due to an imbalance between the amount of iron absorbed by the body and the amount of iron required by the body as consequences of low iron intake or infection. Underlying causes influencing households and communities can be grouped under the three broad categories of food insecurity, inadequate care and practice, and poor public health. Issues like low content of available iron and Vitamin A and high content of inhibitors comes under the first category while inadequate care and lack of proper feeding habit/practice comes under the second category. Lastly the poor iron supplementation, health, hygiene, sanitation and health services come under the third one. Resources and control over it, political and ideological factors, economical structure, cultural factors, organizational resources that defeat the best effort of households to attain good nutrition are described as basic causes of IDA.



Source: Adapted from UNICEF 1990

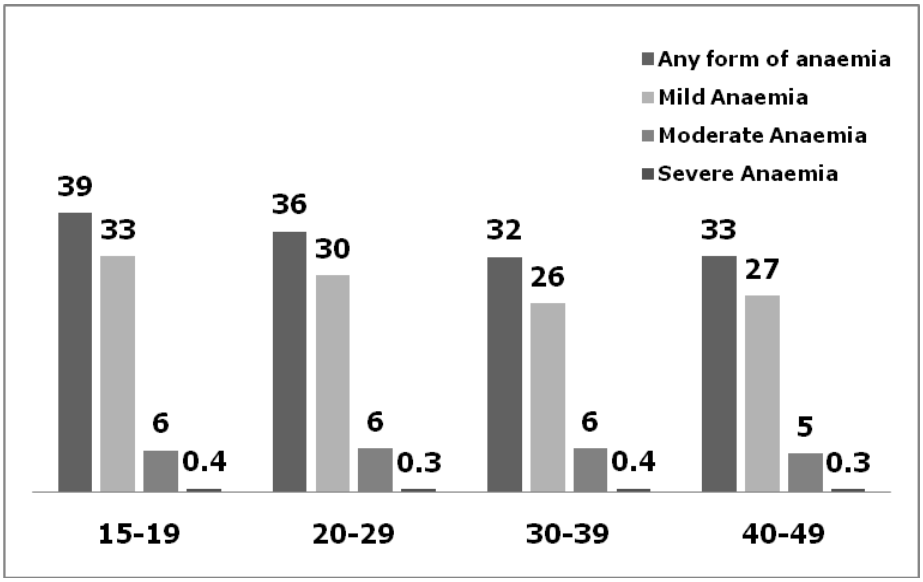
Figure 4: Conceptual framework for Iron Deficiency Anaemia

CHAPTER III: STUDY RESULTS /FINDINGS

3.1 Epidemiology of IDA among females in Nepal.

IDA is one of the most common nutritional problems in Nepal affecting 35%(28) women of reproductive age group (15-49 years). The survey of NDHS 2011 shows that adolescent (15-19 years) are more anemic (39%) than other reproductive age group women.

IDA in adolescents' girls is unevenly distributed over the country. A community based study on Terai region of Nepal in 2009 shows even higher(78%) (29) prevalence of IDA than the results of NDHS 2011 survey. Recent hospital based retrospective study conducted on same region in the year 2012 shows that 29.4% female adolescent are anemic(30) Similar study on Far western region of Nepal in the year 2013 shows 57% adolescent girls are anaemic(31). Anaemia prevalence among adolescent is high in all form of anaemia from mild to severe. In case of children, the more anaemic children (more than two third) are found in between age of six to twenty three month. (16) Similar result has been found in the study conducted in two different part of country among children below three year. The result shows that (40-58) % children are anemic and (16-43) % are suffering from IDA (32, 33).

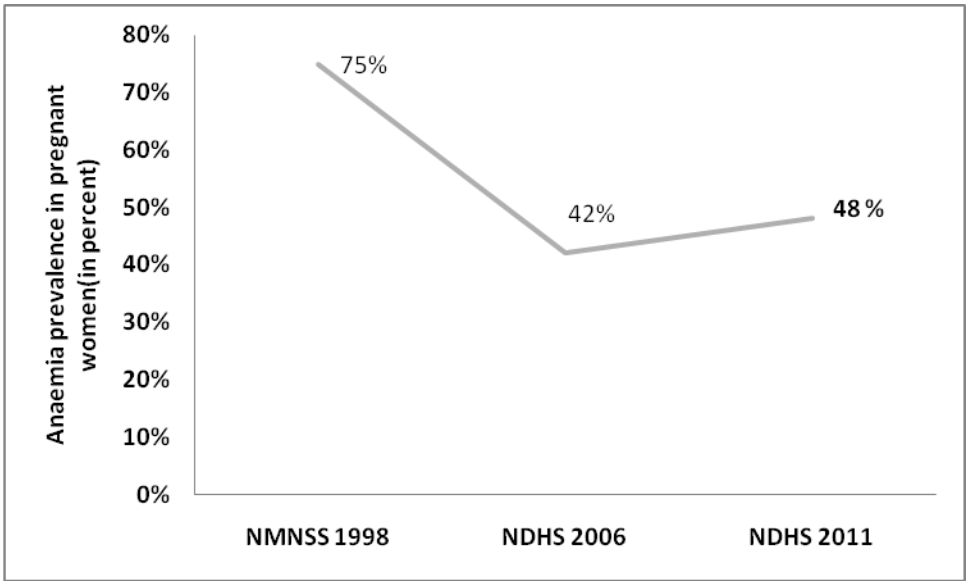


Source: NDHS 2011

Figure 5: Prevalence of anaemia in different age group of reproductive age women (in per cent).

Similarly, almost half of pregnant women in Nepal have some form of anaemia. The situation did not improve in the last decade. Anaemia

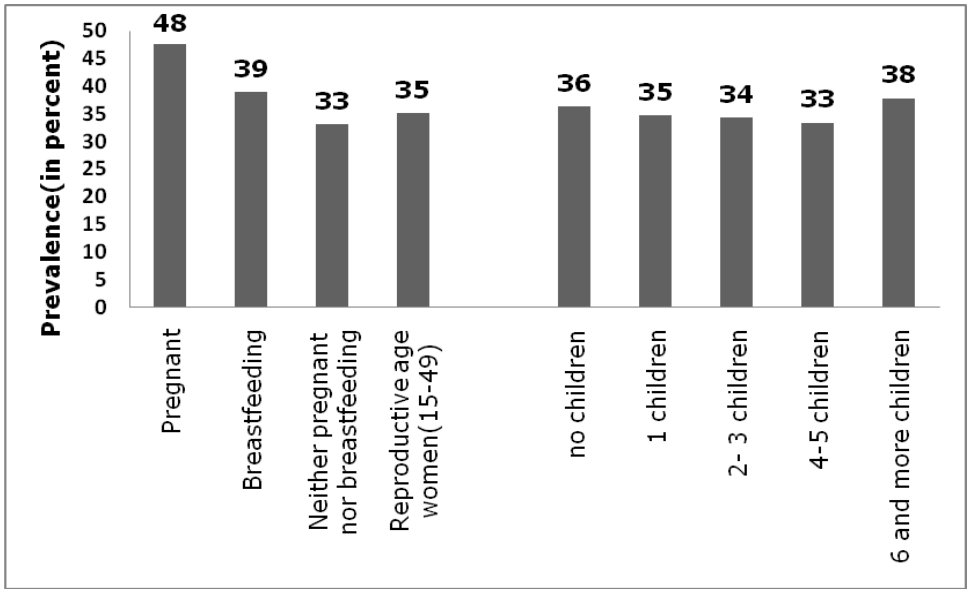
prevalence among pregnant women was 75% in 1998(21) which was reduced to 42% in 2006(22) and still 48% pregnant women are anaemic in the country as illustrated in the figure 6. During the eight year period from 1998 to 2006, there was a decrease of anaemia prevalence by 44% but during the five year period from 2006 to 2011, it increased by 14%.



Source data: NMNSS 1998, NDHS 2006 and 2011

Figure 6: Trend of anaemia among pregnant women

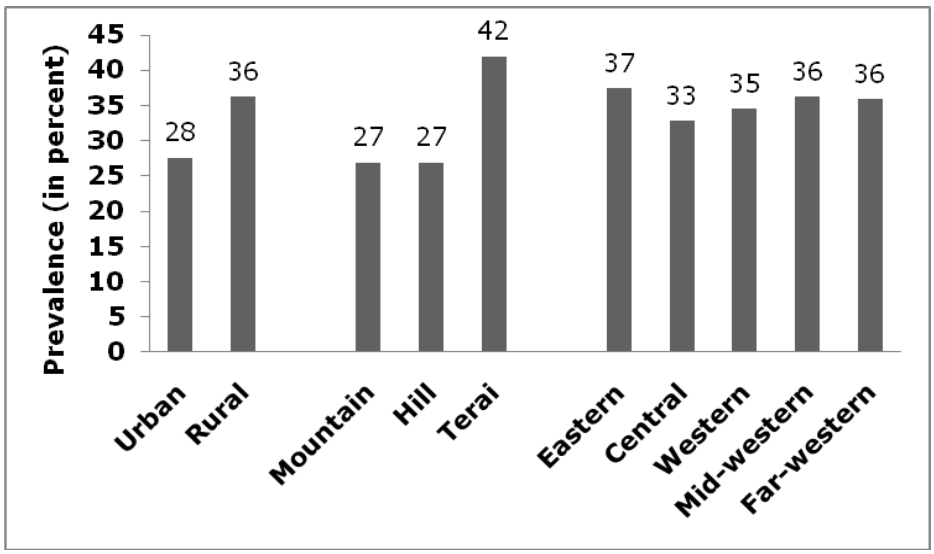
Anaemia is also prevalent among breast feeding women; nearly four women out of every ten have some form of anaemia. Women of reproductive age who are neither pregnant nor breastfeeding seems to be less anaemic. In Nepal, more than one third of women who are reproductively active are anaemic. According to the NDHS 2011 survey, women who have six or more children tends to be more anaemic than the women who don't have any or one children(16).



Source: NDHS 2011

Figure 7: Prevalence of anaemia according to maternal status and number of child ever born

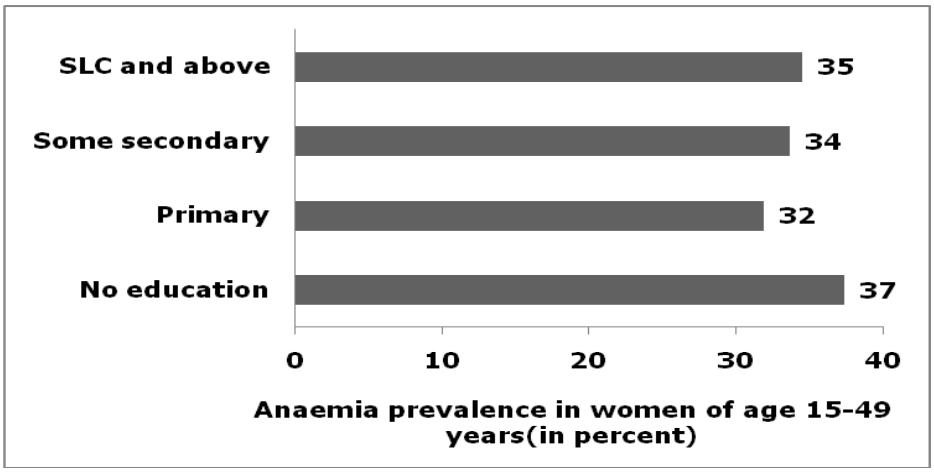
In Nepal, prevalence of anaemia among women is higher (36%) in rural than urban area (28%). Similarly, anaemia is more prevalent in the Terai region than the mountain and hilly region which are 42% and 27% respectively. More than four out of ten women living in Terai region are anaemic. A community based study in 2009 in Terai region also shows the similar results where both in urban(84%) and rural(74%) areas there is a higher prevalence of anaemia among adolescent girls(29). Similarly, study in a semi urban setting among adolescents shows 69% anaemia prevalence(34). Some variation can be seen in the distribution of anaemia among women in different development regions. Central development region shows low (33%) and Easter development region shows high (37%) cases of anaemia compared to other development regions.



Source DHS 2011

Figure 8: Prevalence of anaemia in women of reproductive age group according to ecological and political distribution of land.

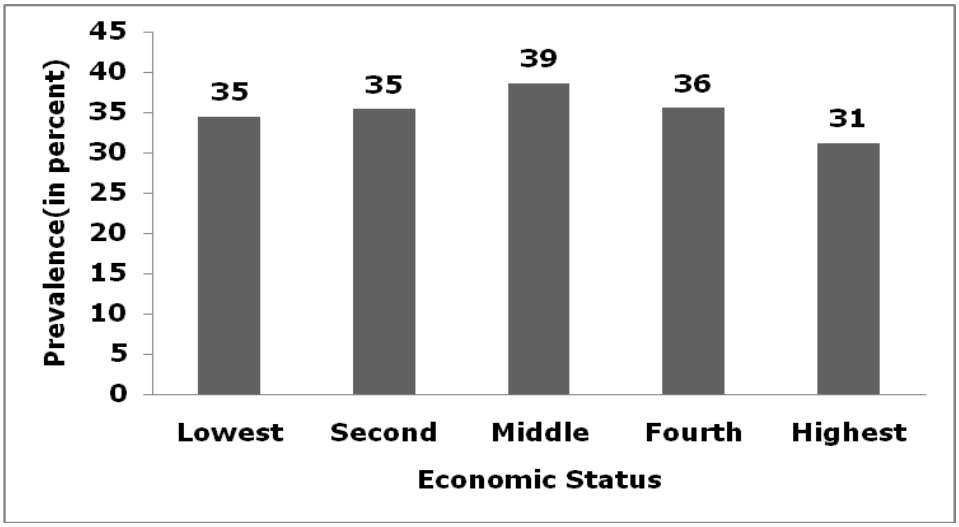
The NDHS survey 2011 reveals that there is no strong linked between education status and prevalence of anaemia among women and even less among mothers of anaemic children below five years. It is expected that with increased in educational status, anaemia prevalence should decrease but data shows only a difference of 5% between illiterate and primary educated. Similarly, only a two per cent difference is found between illiterate and SLC and above qualified women as shown below in figure 9.



Source: NDHS 2011

Figure 9: Prevalence of Anaemia in women according to educational status.

In Nepal, NDHS 2011 study shows that anaemia is more prevalent among middle class families (31%) and less in highest quintile of wealth. Families with other economic status show not much difference in anaemia prevalence, almost the same at 35%. Anaemia is common and nearly one third of women were affected in Nepal irrespective of their economic status(16).



Source: NDHS 2011

Figure 10: Prevalence of anaemia in women according to wealth quintile

3.2 Contributing factors of IDA among females in Nepal.

The conceptual framework prepared by UNICEF in the year 1990 has been used to describe the main three contributing factor or cause of IDA in context of Nepal.

3.2.1 Immediate Cause

Immediate causes/factors are those causes that are associated with individual level poor health status and the low intake of iron in daily diet.

Inadequate intake of Iron rich diet

A normal HH in Nepal has a two time meal and one time snack. The meals consist of Bhat (rice), Daal (pulses) and Tarakari (vegetable curry). A major proportion of this meal is the rice and it depends upon the geographic area,

availability and economic status. People who live in rural areas and grow maize only often replace the rice with maize pudding. HHs often has animal products once in a week depending upon the economic status and availability (rural). So the regular Nepali diet is a cereal based vegetarian diet. The diets consist of high carbohydrate and low protein, fat and minerals including iron. The side dishes (vegetables) contain most of the iron. Culturally, women in the household consume last of all family members, often getting their good shares of side dishes(35). The regular Nepali diet firstly lacks the necessary regular micronutrients, secondly due to cultural and economic factors, the dishes which have little micronutrients are unavailable for the women in families leading to even lower intake of iron. The Nepal MNSS reveals that 71%(21) women have inadequate dietary intake of iron.

Disease: Worm

Worm infestation is another important cause of IDA. It is believe that hook worm infection damages the lining of regular intestine resulting in blood loss(0.3-0.5ml daily)(36) hence loss of iron resulting in anaemia. It is found that moderate hookworm infection nearly doubles the iron requirement for women(37). In Nepal (55-85)% of drinking water sources are contaminated (38) increasing risk of helminthic infestation. Anaemia in pregnant women is strongly associated with hookworm infestation. A study in Terai region shows 46% of helminthic infestation found in a sample population with 59% anaemic women(39). In a similar setting, it is found that 73% of pregnant women are anaemic with 88% caused by iron deficiency and three out of four women have hook worm infestation. In that study it is also found that 54% women have Vitamin A deficiency and 20% have malaria(24). Another study in a similar setting found similar results: where 59% of pregnant women were anaemic and helminthic infestation was found in 46%(39).

Generally the malaria parasite destroys the red blood cells and suppresses its production(40). It is estimated that 2-15%(41) of anaemia prevalence occurs in pregnant women who live in a malaria endemic place. Plasmodium Vivax is the most common type of malaria in Nepal and approximately 13.02 million people (47.9%) live in malaria endemic areas and nearly 1 million live in high risk areas which represent mostly the Terai region of the country(13). Women living in this endemic area are more prone to anaemia than other women. A study conducted in Terai of Nepal also shows that 19.8% pregnant women had malaria (plasmodium Vivax)(24). Studies show that treatment of malaria during pregnancy has positive effect in reducing anaemia and low birth weight(41).

Besides hookworm infestation and malaria, other infections/chronic inflammation also can lead to IDA. Helicobacter pylori reduced poor iron absorption by increasing blood loss and reducing stomach acid. In addition to this, bloody stools during chronic bacterial diarrhea cause anaemia. Chronic diarrhea also reduces production of RBC by causing mal-absorption and under-nutrition. The inflammation due to the chronic disease makes anaemia more severe by increasing metabolism and therefore the iron requirement(40). In the context of Nepal, diarrhea is a common disease affecting all age groups especially in rural area where the sanitation and personal hygiene is not well maintained and almost 86% of HH (using unimproved water sanitation) didn't use any kind of treatment for drinking water and 38% HH defecate in open spaces.

3.2.2 Underlying Cause

Low content of available iron and Vitamin A

Iron (in heme form) available from animal source food is easily absorbable by the body (25-35%) is lacking in the normal diet of the Nepali HH. Nepali women tend to avoid a animal product during their periods(42) which allows them less iron during the period when they need more. The dietary pattern of Nepali household is more energy based and low in micronutrients. This leads all family members including women to a deficiency of required nutrients, including Vitamin A which plays an important role in synthesis of hemoglobin and has an adverse effect on IDA. It is found that women of Terai met only half of their Vitamin A requirement (24). Food security at household level is also a serious issue for several nutrition problems like IDA. An FAO study in 2010 shows that around 40% of rural HHs produce enough food to meet their year round needs and HHs from food insecure district produce food that remains them for only three months(43). World Food Program in its study in 2008 revealed that 75% of normal HHs and 95% of very poor HHs did not have sufficient access to food. Similarly, 16% of rural HHs have very poor food consumption patterns and consume maize on a daily basis complemented by rice, barley and tubers(38). Another national wide survey shows that 30% of rural HHs consumed a nutrition-poor homogenous diet(44).

High content of Inhibitors

The absorption rate of non heme iron from food (plant sources) is lower (only 2-20%) compare to the absorption of heme iron (25-35%). The absorption rate is further reduced due to the presence of dietary phytate which acts as inhibitors for iron and other mineral absorption(45). Phytate is present in cereals such as wheat, rice, maize, etc. Deficiency of other micronutrients like Vitamin A and C, folate, B12, and riboflavin further

contribute to IDA as these are required in the formation of hemoglobin(35). A study conducted in the western part of the country showed that phytate-rich grains contribute over 85% of the energy requirement in the majority of women investigated(35).

Diet low in Iron and Inadequate care of women

The daily iron requirement of females during menstruation increases to compensate the loss and iron requirement is also high for the rapid growing period. It is even higher during pregnancy and lactation periods. In the Nepalese context there is no culture of offering extra food in this period except after delivery for two to three weeks where mothers are offered nutritious food. This is prevailing only in certain ethnical group. Care and support in terms of food to overcome iron loss is very limited which results in many complications and nutritional problem including IDA. NDHS 2011 reported that 18% of women are malnourished and 48% are pregnant, 39% lactating women and 35% reproductive age women are anaemic.

Early and repeated pregnancy without adequate spacing and absorbable iron in diet results in iron deficiency in the body. The period between the pregnancies provide some time to recover the iron supply in the body as iron is needed enormously during the pregnancy, lactation(46). In Nepal, child bearing age starts early. One fourth women give birth by age 18 and 17% of adolescent women are already mothers or pregnant with their first child. Similarly, there is not a big variation between the percentages of anaemic mothers with their children ever born but the NDHS study shows that mothers who have six or more children and with no children are more anemic than others(16).

Poor Iron supplementation, Poor health services and Poor environment and sanitation

Another factor for causing IDA is poor available services and the environment and sanitation where the people live. IDA can be controlled and treated by supplementation of iron, deworming, vitamin A supplementation, and by limiting and spacing child birth. Early treatment of common infections like diarrhea and other disease also can be helpful directly and indirectly in controlling IDA. Awareness of IDA and FP services, importance of iron and other nutritious foods during pregnancy can be raised during ANC, PNC checkup and through other sources. But coverage of ANC and PNC visit is limited to 59% and 57%(15). Compliance of taking 180 and 45 tablets during pregnancy and post-partum is still an issue. Pregnant women taking all 180 IFA tablets during pregnancy is limited to only 52% and post-partum mothers taking IFA tablets for 45 days are limited to only 49%. The trend of this has not been changed in from last three years(13).

Unmet needs of FP services which helps in spacing or limit child number is still 25%(15). Similarly, maintaining good sanitation can reduce the helminthic infestation and providing drug for infestation can reduce the IDA case. But the services provided by the health facilities are not going well as expected. 38% of HHs still lack toilets and most of them are living in rural areas(9).

Inadequate knowledge about IDA and Iron rich diets

Knowledge on IDA, the importance of nutritious food and environmental sanitation, diet diversification, ANC and PNC check-up, importance of FP services, etc. play an importance role in maintaining good health at individual and family levels. An awareness level on these issues of people especially in rural and even the marginalized population in urban areas is very low. Only 57% of female are literate in a country where as only 45% of women in rural areas and 43% of women from Terai can read and write. So they are unaware of how they can overcome malnutrition and other health consequences locally. For example, the locally prepared dry food item Gundruk made of leaves of spinach can be the good source of Iron and daily use of pickle enhances the iron absorption. It contains 94.3 mg(47) of iron per 100 g but many people do not considered it in their daily intake and children are reluctant to eat.

3.2.3 Basic Cause

Inadequate access to services

The nutritional problem in a country can be reduced through appropriate awareness campaigns and provision of appropriate health services and treatment. In Nepal, where 83% of the population lives in the rural part and health facilities provide basic health services, the accessibility of services are hindered geographically as well as by knowledge of the importance of nutritious food and its impact. Only 57% of women who are the key members in preparing food in family are literate(9). This may be the reason for higher anaemia prevalence in rural areas (36%), Terai (42%) and hilly part of the country than the other parts(16).

Inadequate financial and human resources

Economic status plays an important role in maintaining good health of people individual as well as at the community and national levels. HHs with good economic status can have diet diversification. At the community and national levels, it can make appropriate health care services accessible to all households. The country can best intervene to target population to reduce nutritional problems like anaemia. But with a lack of financial resources, people are not accessing all required health services. Similarly, the

government is unable to cover all targeted populations who are at higher risk of IDA. Lack of financial resources may be the reason that the government has only one program(IMNMP) that covers all districts and population and anaemia prevalence is higher in the lowest wealth quintile population(16). Other targeted interventions are limited to certain districts and regions.

Socio-cultural, economic and political context

The status of women in a family and community play an important role in occurrence of IDA. Generally, in Nepalese HHs women are not given priority compared with other family members with regards to their health needs and diet. More than three fourths of HH heads are male. Females have much less decision making power.

The culture of early marriage at childhood is still prevalent in some ethnicities resulting in early pregnancy and child bearing. Pregnancy is considered a normal part of life and attention and care is not a high priority. Females are supposed to do all household activities and outdoor agricultural work that require more energy and food. A report shows that 18% women are malnourished(16).

Similarly, political insurgency (Mid 90s to early 20s) for ten years in the country also played an indirect role in the nutrition status of women especially in rural parts and even in urban. During those periods security is more concerned than the other needs. People have to leave their house and have to live in temporary places where they face further food insecurity.

Other factors like political instability, financial resources, accountability of service providers, and lack of community participation in management of health facilities and interventions, and harmful socio-cultural practice also play an indirect role in occurrence of IDA in Nepal. On the other hand the targeted interventions are not implemented on a sufficient scale to have a large impact on women's nutritional status and often have difficulty reaching the poorest(48).

3.3 Current program Response.

The 1998 NMNSS report of anaemia which revealed that almost three out of four women were anaemic made the government give priorities to the IDA problem. As a the result of that study, government formulated the national strategy for the control of anaemia in 2002 and later on a five year plan of action for the control of anemia among women and children.

The Government started the IMNMP program in the year 2003 to increase the coverage and compliance of the IFA supplementation. Coverage

increased drastically from 47% to 86% ANC attendance increased to 92% in program districts(46). From 1998 to 2006, the IDA trend in Nepal showed good reduction in prevalence to 47% in reproductive age group women and by 44% among pregnant women.

By 2006, this program was extended to 20 districts which had higher prevalence of anaemia. The most important part is the IMNMP program was the involvement of FCHV in delivering the IFA. FCHV is the key pillar of the health system of Nepal. It connects the community with government health services. During this period (1998 to 2006), the packaging of IFA was also modified to be more users friendly which reduced the wastage. In the mean time, the government also initiated the vitamin A supplementation and deworming program to pregnant women as a pilot project.

The government of Nepal has demonstrated a high commitment and priorities for nutrition with an adaptation of Multi Sector Nutrition Plan (MSNP) in 2012 which was based on the recommendations made by the Nutrition Assessment and Gap Analysis (NAGA) report 2009(49). The Ministry of Health and Population has implemented multiple strategies and evidence-based nutrition interventions through its MSNP. These multiple interventions focus on the overall improvement of the nutritional status of the Nepalese people with a special emphasis on vulnerable populations like young children and pregnant women.

Nutrition Specific Policies

- Health Sector Strategy for Addressing Maternal Under nutrition (2013-17)
- Multi Sectoral Nutrition Plan 2013-2017 (2012)
- Mandatory Flour Fortification (2011)
- Maternal, Newborn and Child Health Communication Strategy (2011)
- Nutrition Assessment and Gap Analysis (NAGA) 2009
- Communication Framework for Maternal, Infant and Young Child Nutrition
- National Emergency Nutrition Policy (2008)
- National Nutrition Policy and Strategy Revised (2008)
- National School Health and Nutrition Strategy (2006)
- Five-Year Plan of Action for the Control of Anemia among Women and Children in Nepal (2005)
- National Nutrition Policy and Strategy (2004)
- National strategy for the control of Anaemia among women and children of Nepal (2002)
- National Nutrition Guideline 1998
- Joint Nutrition support program 1976

Source: Adapted from Nepal Nutrition Profile 2014

Box 1: Nutrition specific policies in Nepal

In regard to this, control of IDA is always an important component of overall nutrition strategy in the country(50).

Government strategy to address IDA problem in country(51)

Nutrition related Key Strategies

- Supplementation of foods
- Food Fortification
- Promotion of Public Health Measures
- Promotion of food based-approach.

IDA control specific Key Strategies

- Iron Folic Acid supplementation for pregnant and post-partum mothers.
- Intermittent Iron Folic Acid supplementation for adolescent girls
- Multiple-micronutrient supplementation for the children aged 6-23 months.
- Iron fortification of wheat flour at roller mills.
- Parasitic infestation control among nutritionally vulnerable groups through deworming among pregnant women and children aged 12-23 months.
- Nutrition education to create awareness on importance of iron in nutrition, promote consumption of iron rich foods and promote dietary diversities in daily diet
- Advocacy to promote dietary diversities among policy makers.

Source: National Nutrition Policy and Strategy 2004

Box 2: Strategy to address IDA problem in Nepal

Currently, two separate divisions (the Child health division and the Family health division) under the DoHS have been implementing the interventions that target IDA while other health services are providing by other Divisions and Centers of the DoHS. Some of these interventions/programs which run at individual, family and community levels and are directly and indirectly related to control IDA problem in country are the following:

Programs that directly linked with control of IDA

Currently, the government has been implementing only one intervention targeting to reduce/control IDA among women.

Increase Intake of Iron in diet and Diet diversification/modification

Along with short term strategies like supplementation, the government also initiated some on medium term strategies (fortification of flour) and long term strategies (nutritional education, diet medication and diversity, improving food security and socio-economic development) co-coordinating with other ministries and departments. MoHP has prioritized a food-based approach for control of anaemia. It is also included in the strategy of government. Normally, the FCHVs at community level provide some nutrition awareness on importance of IFA supplementation and nutritious food during

pregnancy and the lactating period. Similarly, in ANC-PNC visit normal counseling on types of food that are required during these periods is done at the health facility level. But in fact, there is not specialized program to food based approach which helps in diet modification/diversification at household level.

Iron and Folic Acid (IFA) supplementation:

The Ministry of Health and Population has been supplementing IFA to pregnant and post-partum women since 1998. In the beginning supplementation was provided through health facilities but in 2003, Intensification of Maternal and Neonatal Micronutrient Program (IMNMP) was initiated to improve coverage and compliance of IFA through different awareness raising activities, advocacy, information through media and training of health workers/volunteers at all level. The IFA supplementation was distributed by the Female Community Health Volunteers at the community (ward) levels. IMNMP has shown success in increasing attendance at ANC clinics, taking IFA supplements and taking medicine(46). The Program has been implemented in a phased wise manner and now it covers all 75 districts of the country. Government of Nepal has adopted the following strategies specific for this program:

- Create awareness of anaemia and importance of Iron supplementation
- Increase accessibility of iron/folate at the family and community level
- Ensure availability of iron/folate supplements at all health facilities and outreach clinics (ORC)
- Create awareness about improving living conditions including sanitation and hygiene
- Increase awareness about iron rich foods, of both animal and vegetables sources
- Advocate for equity among genders in access and control over household food
- Create awareness about the importance of increased food intake and reduced work load during pregnancy
- Promote advocacy campaigns against teenage pregnancy, early marriage and short birth spacing
- Develop a scheme for screening and diagnosing of high risk women for severe anaemia

Source: Five-Year Plan of Action 2005 in Nepal (2005)

Box 3: Strategy for IMNMP program in Nepal

National protocol on Iron Supplementation for Pregnant women

Dose : 60mg of Iron+400 µg folic acid, Daily
Duration: From the beginning of the second trimester in pregnancy (6 months) till 45 days postpartum (total 225 days).

Source: National Anaemia control strategy 2002

This program has helped to increase the coverage of IFA supplementation but continuation of supplementation until 180 days and until 45 days after delivery is not as good as expected. The trend of the last three years shows static data on coverage of first distribution of IFA to pregnant women by FCHV/health facilities around 80% while coverage for 180 days distribution is low (around 50%) and even low in case of 45 days post partum distribution of IFA. Similarly, the latest annual reports show only 52% of women and 49% of post-partum women receive 180 days and 45 days IFA supply respectively. The policy emphasizes nutrition education, hygiene and sanitation, health and promotion of iron-rich food during pregnancy and post partum but implementation of such things are very weak(16).

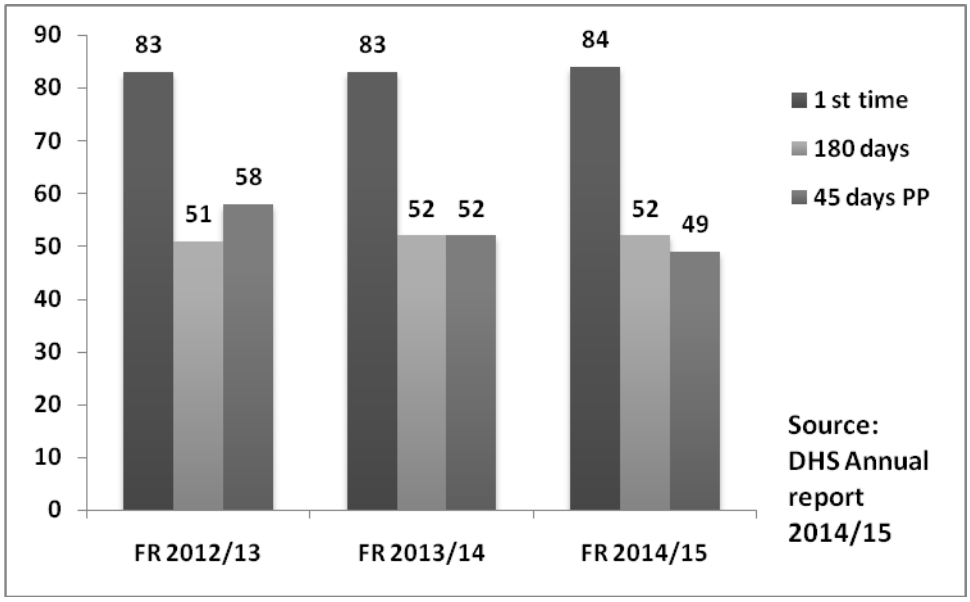


Figure 11: Trend in IFA distribution as % of expected live birth in last three years

Micro-Nutrient Powder (MNP)

To address the micronutrient deficiency including iron, Government of Nepal started Micro Nutrient Powder (MNP-Baal Vita) only focusing on children

under age two. This program started in 2008 as a feasibility study program in two districts. In 2009, MoHP piloted the home fortification of complementary food with MNP for children below two years in six districts integrating with community IYCF programs. This program is now implemented in 15 districts of the country with an objective to improve micronutrient status at children's early stages. MNP consists of multiple micronutrients with key micronutrient being iron, vitamin A and zinc. Detail is shown in table 1.

Table 2: Scheme for home fortification with MNP consumed by infants and children 6-23 months

Composition per sachet	• Iron: 10 mg • Vitamin A: 400 μg (retinol) • Zinc: 4.1 mg
Frequency	One sachet per day
Duration and time interval between periods of intervention	At minimum, for a period of 2 months, followed by a period of 3–4 months off supplementation, so that use of the micronutrient powders is started every 6 months
Target group	Infants and children 6–23 months of age, starting at the same time as weaning foods are introduced into the diet
Settings	Populations where the prevalence of anaemia in children under 2 years or under 5 years of age is 20% or higher

Source: WHO 2011 (52) **UNICEF 2015** (53)

The latest annual report of department of health service of Nepal shows that there is need for proper counseling and follow up to improve the compliance. MNP distribution status shows that 78.8% children have taken their first dose and only 4.6% of children from 15 districts have taken third dose of MNP.(13)

Vitamin A Supplementation program:

With an objective to control the vitamin A deficiency which can contribute many health consequences including IDA, the National Vitamin A supplementation program started in 1995. In this program a high dose of vitamin A (200,000IU) is given to post-partum women (within 45 days). Though there is guideline for Vitamin A supplementation for post-partum mothers, the coverage is very low. The latest annual report shows that nationally only 49% of post-partum women receive Vitamin A supplementation. The coverage is even lower(46%) in central development region and higher(61%) in the Mid-western development region compare to other regions(54).

Mass Flour Fortification via large roller mills

The Government of Nepal initiated mass flour fortification in Maida and Atta flour in 2002 as a pilot and volunteer program. The government then built up the volunteer standard in 2006. Government made fortification in roller mills mandatory in 2011. Currently, roller mills which are part of the mill association in the country produce fortified flour. Still roller mills which are not part of association (around 20%) are not taking part in this fortification program. Micronutrients mainly Iron (60mg/kg), Vitamin A (1mg/kg) and Folic Acid (1.5mg/kg) are fortified in Maida and Atta(54, 55).

Fortification of Vitamin A is mandatory for vegetable ghee and voluntary for cooking oil. A feasibility study in 1997 showed that 75% of urban and 43% of rural households consumed these products(56).
There is lack of study on impact and effectiveness of fortified food products on individual health. Similarly, monitoring and awareness parts at the government level is very weak in both of these programs and use of this fortified flour by rural HHs is very limited due to dietary patterns and economic status.

Deworming program

Intestinal parasites are one of the factors contributing to anaemia among pregnant women in Nepal. The Government of Nepal started National Deworming Program (NDP) in 2004. Under this program pregnant woman are provided with a single dose of Albendazole (400mg) during their second trimester of pregnancy as a part of ANC(13). NDP also creates education and awareness of adequate hygiene practices. The Annual report of MoHP shows 75% coverage of deworming among pregnant women which is satisfactory. The coverage is higher (89%) in the western development region and lower (61%) in central the development region(54).

In addition to this, under the School Health and Nutrition Program, all school children at government schools are provided with deworming tablets biannually to reduce helminthic infestation. But this doesn't include adolescents studying in the private schools and adolescents who are not studying at any school, leaving a large proportion of adolescent girls.

Malaria control Program

The Malaria control program is one of the oldest health programs in Nepal. It started in 1954 and is continuing with different names. The government prepared the National Malaria Strategic Plan (NMSP 2014-2025). Under these strategies, government has been implementing many interventions or activities. Some of them are bi-annual Indoor Residual spraying program at malaria moderated risk district which include total of 255 VDC, distribution

of long lasting insecticide-treated nets (LLIN) in affected area, regular case base surveillance conducted based on malaria positive case record.

The latest annual reports show decreasing trends of clinical as well as laboratory confirmed malaria cases but malaria cause by indigenous plasmodium vivax may still become a challenge as it shows a slower decreasing trend than plasmodium falciparum. Malaria incidence in 2014/15 showed 0.10 per 1,000 at risk population.(54)

Family Planning services

The family planning program is one of the important services provided by government health facilities in Nepal. These facilities provide mainly four kinds of services: voluntary surgical contraception, spacing methods, and Family Planning counseling and referral services. These services are also provided by the private sector. The fertility rate is 2.3 births per women aged 15-49 years and is higher (2.5) in rural areas than in urban areas (1.4).The Nepal Multiple Indicator Cluster Survey (NMICS) in 2014 showed that around half (49.7%) of women of reproductive age are currently using a contraceptive method. The same report also shows that there is an increasing trend of using contraceptives among women (65%) of age 40-44 years compare to younger women (19%) of age 15-19 years. There is unmet need of family planning for one fourth (25.2%) of women of reproductive age. Ten out of 25% of this unmet need is for spacing and is higher (43%) among younger women of age 15 to 24(15).

Programs that leads to good Maternal Nutrition or indirectly linked with control of IDA

Many other projects implemented by the government with collaboration of donor agencies which have indirect effects on the IDA. Most of these projects are in their initial or middle phases so not much known is about their effect and impact on the individual and community. Furthermore, these projects are limited to certain geographic area and districts depending upon the needs and situation of the population. These projects/interventions are directed towards fulfilling their own objectives but also help in reduction of IDA indirectly.

The government of Nepal has been implementing several programs under the Family Health Division that have components and activities that directly and indirectly contribute to the maternal nutritional status including anaemia. These programs include the National safe motherhood program, birth Preparedness Program, Family planning Program, FCHV program, and the Primary Health Care Outreach Program. The combination of all these programs helps to create awareness of different issues like the importance of

additional dietary intake during pregnancy and lactation. Similarly, it also helps in strengthening nutrition education and counseling to improve the iron status of pregnant and lactating women, reducing workload, preventing early pregnancy, ensuring adequate birth spacing, and promoting social support for maintaining good health and dietary habits. The Government has implemented these interventions in all parts of the country mobilizing all its resources.

Suaahara: an integrated Nutrition Program

Suaahara is five-year (2011-2016) integrated nutrition project implemented in 41 districts. The aim of the project is to improve the nutritional status of women and children through life influencing behavior of individuals and communities through community-based behavior change programming with a special focus on most disadvantaged groups. The Suaahara project focuses on four primary results which include:

- improved household health and nutrition behavior,
- increased use of quality nutrition and health services by women and children,
- increased consumption of diverse and nutritious food, and
- Co-ordination of government with other sector for better nutrition

This project is an integrated approach which includes nutritional specific intervention, agriculture, WASH, and health promotion with four cross-cutting themes: gender and social inclusion, behavior change communication, social mobilization and governance and monitoring and evaluation. This project has a good impact on community to increase the level of knowledge on importance of yellow and green leafy vegetables during pregnancy, increase in institutional delivery, and transforming community's nutritional behavior. Based on these good results it is now concentrated on expansion to 16 other districts.(13, 57, 58)

The most cutting –edge nutrition program in the world

"As a global nutrition community, we now know the critical importance of integrated projects to achieve maximum effectiveness. Suaahara does this, and that is why it's showing impressive initial results."

Dr. Patrick Webb
Dean for academic affairs of the Friedman
School of Nutrition Science and Policy at Tufts University

Source: Save the children 2016
https://everyone.savethechildren.net/articles/impact-suaahara-program-nepal

Agriculture and Food Security Project (AFSP)

This five-year (2013-2018) project is designed to address food and nutrition security issues. The Ministry of Health and Population, in collaboration with the Ministry of Agriculture implemented in 19 hill and mountain districts of the Far and Mid-western development regions where there is a problem of HH food deficiency. The main objective of the project is to enhance household food and nutritional security through increased agricultural productivity (both crop and livestock), household income and improved nutritional practices through promotion of diversified diet and improved feeding and caring practices for pregnant, nursing women and children up to two years(13).

SABAL

SABAL is a five-year (2014-19) project covering six central and five eastern districts of Nepal. The main goals of project are to strengthen and diversify the livelihood of people and improve health and nutrition status of pregnant and lactating women and children under five with their families. The project aims to improve financial literacy, savings and promote productive investment of remittance income, strengthening women's participation in decision making to fulfill the first goal while adopting the Essential Nutrition Action framework (ENA) to achieve second goal(13, 59).

Maternal and Child Health and Nutrition Program (MCHN)

A food supplementation program (Maternal and Child Health and Nutrition Program) was implemented by the government in 2001. Under this program, the government has been providing food assistance to pregnant and lactating mothers and children aged 6 to 23 months. A monthly take home ration of fortified supplementary food is provided along with health services, growth monitoring, and counseling from community and government staff. This program is running in six highly remote and food insecure district(13).

Golden 1000 days Project

This is a five-year project (2012-2017) implemented in 15 districts of eastern and central Nepal. This project aims to improve the attitude and practices which helps to improve nutritional outcomes of women of reproductive age and child below two years.

3.4 Best practice intervention in world

Supplementation of IFA to the targeted population is the one of the most common and effective strategies followed in the world. Studies shows that iron fortification and iron supplementation are the most cost effective interventions to reduce iron deficiency in four sub regions of the world(60). Currently 85 countries have legislation mandating iron fortification(61).

The Lancet Series(62) reviewed on the efficacy of interventions that reduced morbidity and mortality resulting from under nutrition classified recommended intervention in two categories. The first category is the interventions with sufficient evidence to implement in all countries which include iron and folate supplementation and maternal supplementation of micronutrients. The second category included the interventions with sufficient evidence to implement in specific situational contexts which include maternal supplementation and deworming in pregnancy, intermittent preventative treatment of malaria, and insecticide treated bed nets.

The lancet series identified IFA supplementation as a core intervention for pregnant women. The study suggested an increase of 12g/dl in hemoglobin at term and a 73% reduction in risk of anaemia in term which further estimated that this reduction in anaemia would reduce the risk of maternal death by 23%(62).

WHO recommendations for the prevention, control and treatment of anaemia in women

- *Daily oral iron and folic acid supplementation is recommended as part of antenatal care, to reduce the risk of low birth weight, maternal anaemia and iron deficiency. It is recommend that where the prevalence of anaemia in pregnancy equals or is greater than 40 percent, all women should receive supplements for 6 months during pregnancy and three months post-partum. If prevalence of anaemia is less than 40 percent, supplementation is only needed for 6 months during pregnancy.*
- *When the prevalence of anaemia is >=20% , weekly iron and folic acid supplementation is advised in menstruating women and areas where the prevalence of anaemia among pregnant women is lower than 20%, weekly iron and folic acid supplementation in non-anaemic, pregnant women is advised*
- *Fortification of wheat and maize flours with iron, folic acid and other micronutrients is advised in settings where these foods are major staples.*
- *In malaria-endemic areas, the provision of iron and folic acid supplements should be made in conjunction with public health measures to prevent, diagnose and treat malaria.*
- *In emergencies, pregnant and lactating women should be given the United Nations Children's Fund (UNICEF)/WHO micronutrient supplement providing one RNI (recommended nutrient intake) of micronutrients daily (including 27 mg iron), whether or not they receive fortified rations. Iron and folic acid supplements, when already provided, should be continued.*
- *All pregnant women with active tuberculosis should receive multiple micronutrient supplements that contain iron and folic acid and other vitamins and minerals, according to the UNIMAP, to complement their maternal micronutrient needs.*
- *Multiple micronutrient supplements offer important benefits pregnant women in poor settings, particularly for pregnant women with HIV to reach recommended levels.*
- *Exclusive breastfeeding of infants for up to 6 months of age should be protected, promoted and supported. The beneficiaries include the infant and the mother (i.e. longer amenorrhea, increased birth spacing), as well as the newborn (an important source of iron, which is very well absorbed in breast milk).* ***Source: WHO 2012***

Box 4: WHO recommendation for prevention, control and treatment of anaemia in women

It is reported that the maximum attainable health effects of any iron supplementation program in women between 30 and 44 years is 22% reduction in maternal mortality and 33% in perinatal mortality annually(3). Similarly, the maximum attainable health effect of fortification is considered to be 50% of those receiving supplementation due to consumption of low bioavailability diet by the population in the developing country context.

The meta-analysis of 22 completed trails of iron supplementation for control of anaemia in the developing world in 1999 concluded that "***it appears under highly controlled conditions, supplementation can have an***

impact on anaemia prevalence and that the daily and weekly approaches may have similar impact"*(63).* This analysis also includes nine studies with adolescent groups. The analysis recommended that weekly supplementation of iron and folic acid will be good in a situation where there is high compliance and supervision.

Similarly, in the case of children, a systematic review of 55 trials of iron supplements administering orally, parenterally, or in fortified food, shows improvement in hemoglobin by 0.74g/dl and reduce anaemia prevalence by 37.9% to 62.3% in non-malaria endemic settings and 5.8% to 31.8% in malaria-endemic settings(64).

The review results from the intermittent iron supplementation programs to prevent iron deficiency vary but help in reduction of anaemia. Results show that the absorption of iron from intermittent supplementation appears higher(65).Cochrane systematic review on evaluation of intermittent iron supplementation (1, 2 or 3times/week on non-consecutive days) for non-pregnant women reveals in improvement of hemoglobin by 4.6g/l and ferritin by 8.3µg/l and reduced anemia risk by 27% compared to no intervention. The review also compares intermittent with daily intake and found that women receiving intermittent iron had 26% more risk of anaemia although final mean hemoglobin concentrations were similar(66).

The Cochrane review also compares intermittent (1-3times/week) with no supplementation among children ages 12 years and below. The result shows that intermittent supplementation reduces the risk of anaemia by 49% and IDA by 76% improving hemoglobin and ferritin concentration by 5,2g/l and 14.2µg/l respectively. Again, when compared to with daily iron supplementation, reduction of anaemia by a further 23% is observed(67). Study also reveals that supplementation for at least 12 weeks with or without deworming improved the iron status(68).

The intermittent IFA supplementation program for women and adolescents has been successfully implemented in several countries like Vietnam, India, Cambodia, and Egypt. Though this is less effective than the daily iron it is a good option for controlling IDA and WHO now recommends weekly supplementation to menstruating women, preschool, and school age children in a place where anaemia prevalence is more than 20%.

A recent Cochrane review evaluation of home fortification with MNP among children below two years shows reduction of anaemia by 31% and iron deficiency by 51% compared to a placebo. Though MNP is costly and there are issues of wastage during packaging, WHO guidelines support home

fortification with MNPs for children below two years in a place where prevalence exceeds 20%.

Examples of some of the successful weekly iron supplementation intervention done around the world:

Anaemia Prevention and Control program in Venezuela

In 1992, Venezuela started the fortification of maize (50mg/kg) and wheat (20mg/kg) flours with iron and other Vitamins. These flours are consumed daily by the population and authorities maintain the quality control over the whole process. The result after one year's shows that the prevalence of anaemia in children aged 7, 11 and 15 years drop by 50% and average ferritin concentrations has almost doubled in the first six year(69).

Anaemia Prevention and Control Program in Viet Nam

In 2007, Viet Nam expand the project of weekly distribution of iron folic acid with de-worming to all the women of aged 15 to 45 in a province (250000 women).The project was managed by the provincial health authorities and expand based on evaluation of the one year pilot project in previous year covering 50,000 population of similar target in two district. The result shows that the prevalence of anaemia drop from 38% at baseline to 19% after 12 months and to 18% after 54 months of intervention. Similarly, the prevalence of IDA drops to 3% from 18% at baseline and remain at 4% after 54 months confirming that the condition had essentially been eliminated in this population. This program shows that population based interventions can be efficient and effective in reducing anaemia and IDA in a level below public health concern(70).

Anaemia Prevention and Control program in India

Indian government started a weekly iron folic acid supplementation program as pilot program in 52 districts of 13 states. It covers both school-attending and non-attending girls aged 10-19 years. After one years of implementation, the evaluation shows that prevalence of anaemia has reduced by 24%. For example, in case of Gujarat state it covers 1.2 million adolescent girl and prevalence reduced to 53.5% from 74.2% with estimated compliance of over 90%. The cost per adolescent per year was estimated at US$ 0.58. Later the Indian government introduced this intervention to reach approximately 120 million adolescent girls(71).

Table 3: Some successful weekly iron supplementation in school children and women of reproductive age around Asia

Country	Intervention	Target	Delivery	Total No. (N)	Anemia Pre (%)	Duration Of follow up	Anemia Post (%)
Vietnam	Weekly: ferrous sulphate 200mg (60mg elemental iron) + 0.5mg folic acid; 6 monthly deworming	women of reproductive age	Local Health Workers	250,000	38.0	2 years	19.0
Vietnam	Weekly: 60mg elemental iron + 3.6mg Folic Acid	Women of reproductive age	Social marketing	33,000	45.6	1 year	19.1
India Gujarat	Weekly: 100mg elemental iron + 0.5mg folic acid	Adolescent (12-19y) girls	School	69,000	74.7	17 months	53.2
India Uttar Pradesh	Weekly: 100 mg elemental iron + 0.5mg folic acid; 6 monthly deworming	Adolescent girls (school and non-school attending)	School – supervised. Non- school – non-supervised	150,700	73.3	4 years	25.4
Cambodia	Unclear from report	Secondary school students	School	60,000	21.2	8 month	20.5
Cambodia	Unclear from report	Women of reproductive age	Local Health Workers	33,000	32.5	8 month	33.1
Laos	Weekly: 60mg elemental iron + 3.5mg Folic acid	School girls Women of reproductive age		1230 830	34 49		13 29
Egypt	Weekly: 200mg ferrous fumarate + 3mg folic acid	Adolescents	School	50,000	24	3 month	17.5

Source: WHO (RO- SEA)-2011

Strategy for IDA Control Program

A review article on IDA suggests strategies for IDA control program for low and middle income countries which is also very relevant to Nepal. This strategic framework is focused on sustainability of programs and comprises four main components. The first one is IDA problem identification which can be done at different levels through surveys. The second are the policy options where different short, medium, long and other strategies with specific intervention can be chosen. The third component is the

implementation part, followed by evaluation which can be done through follow up surveys(72).

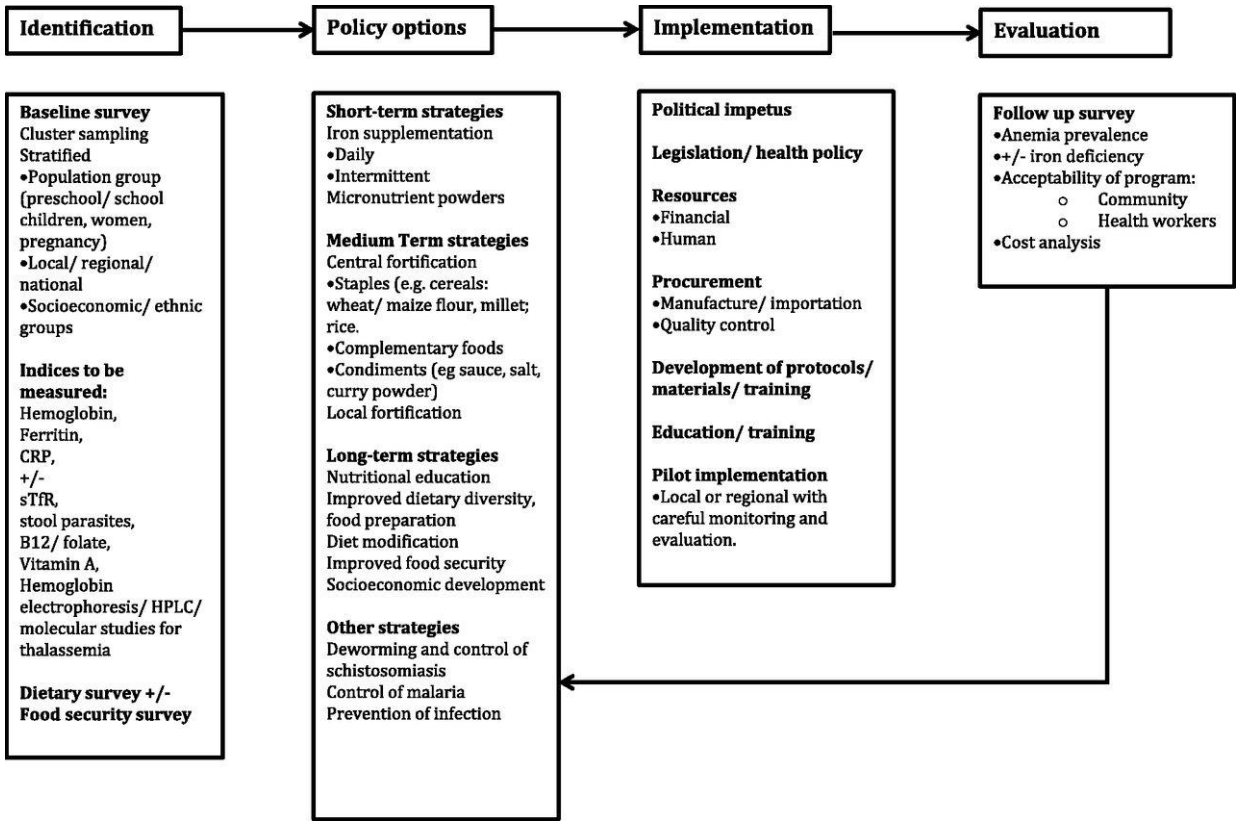


Figure 12: Strategies for IDA control program

Source: PASRICHA et al 2013

CHAPTER IV: DISCUSSION

The literature review showed that IDA is serious public health problem affecting more than one third of the population of reproductive age women with long term health consequences. The problem of anaemia is prevalent in all reproductive age groups of women. Pregnant and lactating women and adolescent girls (15-19 years) are more affected by anaemia. Comparatively, women with six or more children and living in middle class categories are most affected by IDA(16). In Nepal, the problem of anaemia is more common in rural, Terai and eastern and western regions. Anaemia is more observed in illiterate mothers than others although there is not much difference between education level and anaemia prevalence.

Deficiency of iron in the body leads to IDA. In the context of Nepal, IDA is influenced by various interrelated immediate, underlying and direct factors causing different health consequences. Inadequate intake of iron-rich diets and the health status of a women are the two immediate causes of IDA in Nepal which are further linked with the underlying causes (low iron and Vitamin A content in diet, high content of inhibitors, inadequate care of women, poor sanitation, poor health services, and poor iron supplementation) and direct causes (socio economic status and inadequate access to services).

In the Nepalese context, inadequate intake of an iron-rich diet is one of the major factors for IDA. Nepalese meals are a cereal based diet which contains far fewer micronutrients including iron, Vitamin A, and other minerals. Further, diet contains the components like phytate which act as an inhibitor for iron absorption from diet. The cultural practice of eating last by the women further reduces the iron content in the diet because of not sharing all food items. These factors are further stimulates by the level of education and awareness on health and nutritious diet.

Studies showed that there is high demand of iron during pregnancy, lactation, and during growing age of adolescents. This demand is further exacerbated by loss of blood during menstruation. Furthermore, hookworm infestation, malaria, and other common disease like chronic diarrhoea and helicobacter pylori contribute to low absorption of iron in the body. In this situation, it is impossible to fulfill demand of iron through a regular diet.

Supplementation of IFA to these groups is a good way to address with education and awareness on the importance of an iron rich diet, ANC-PNC, family planning, sanitation, etc

Proper and good health care systems incorporating all components including IFA supplementation are also an important factor of causing IDA in Nepal.

Similarly, lack of information, education and awareness on IDA, iron-rich food and locally available high iron-rich food also play an important role in occurrence of IDA.

To address the IDA problem in women the government has adopted almost all key strategies and tries to address most of the determinants of IDA. One of the most important interventions that address the anaemia situation among pregnant and lactating women is the IFA supplementation program. This program fulfills the requirement of iron in the body which is not possible through regular diet. This 2000 program is very important and target oriented and helps to decrease IDA prevalence.

Similarly, under the food based strategy, mandatory fortification of wheat flour with iron, Vitamin A, and folic acid is another intervention targeting the general population.

There are many programs under improved health services and sanitation strategy which help to maintain good health of women and reduce iron loss in the body. These programs include Vitamin A supplementation for post-partum mothers, deworming programs for pregnant mothers, family planning and counseling services, malaria control programs, ANC-PNC checkups, primary health care outreach programs, etc.

Besides these programs the government has implemented a few projects targeting women and children under five in different parts of the country to address nutrition problems incorporating a lifecycle approach along with other component like agriculture, livelihood, food security, education, nutrition, etc. These projects address the dietary diversification/modification strategy of government which is also one of the most important determinants of IDA in Nepal. These are focused on integrated development of household including nutrition status through promoting locally available nutritious and mineral-rich food. Though most of these projects are in the initial phase but integrating with other components in a holistic way can help in the improving nutritional status including IDA. Suaahara, SABAL, Agriculture and food security projects, maternal and child health and nutrition program, Golden 1000 days, etc. are the examples of these projects.

Despite of several efforts made by the government, there is still some issue in IDA control and other intervention which have impact nutritional as well as IDA status. Some of these are as follows:

Low coverage and compliance of supplementation program

A supplementation program is one of the key interventions targeting the most vulnerable groups. It is very useful in addressing the immediate cause of IDA among the targeted population of pregnant and lactating women where iron intake from their diet is low with increased demand of iron in body. Though this program has nation-wide coverage and has good results on reducing the risk of anaemia the compliance of taking 180 tablets during pregnancy and 45tablets during post-partum is an issue. Only 52% women and 49% post-partum women received 180 days and 45 days IFA supplementation(13).

Lack of attention to most vulnerable group:

Findings show that prevalence of anemia is high (39%) among age 15-19 reproductive women. Though IFA supplementation program covers the married women, the unmarried adolescents are left out from the program. There is no specific intervention to address these adolescents. Similarly, the deworming and Vitamin A program is good to support IDA problem among all age groups but government program of deworming leaves out the private school children and children not going to school

Low coverage of Deworming, Vitamin A and Family Planning program

Deworming during the second trimester and Vitamin A supplementation at postpartum period helps in controlling IDA by helping absorption and hemoglobin formation. Similarly, child spacing helps women to recover iron levels in their body. Studies suggests that daily IFA supplementation can reduce the risk of anaemia by 73% and it further reduces the maternal mortality by 23%(62). Although this program addresses the IDA problem, coverage of this program is not satisfactory. There is only 49% nation-wide coverage of Vitamin supplementation to post-partum mothers and 75% (13)coverage of deworming among pregnant women. The unmet need of FP service is around 25% and out of this 10%(15) are for child spacing.

Weak nutrition education and counseling is one of the major problems of government intervened programs and projects. There are some awareness program carried out by FCHV and health staff at different levels but it is not sufficient. Nutritional counseling is almost nil in these settings. This may be the reason of higher compliance of IFA supplementation and other programs. Knowledge and awareness on nutritious value of locally available food and their consumption in daily diet can make a significant improve in nutrition status of women.

Reaching the most vulnerable population group is always an issue in implementation of interventions. Generally, the most vulnerable, poor and marginalized populations live in the rural areas and are often deprived of health services and benefits of interventional programs. For example, the mass food fortification of iron in wheat flour program in Nepal is good in terms of iron supplementation and its impact. But the issue is that majority of the rural population do not use those fortified foods; rather they milled their own grain locally for consumption. The NDHS also shows that women from high quintiles make greater use of IFA tablets during pregnancy than those in the poorest quintiles (84% vs. 28%).

Coordination: Nutritional programs like MNP supplementation, School nutrition, and IYCF are managed by the nutrition section under the Child health division while maternal nutrition is managed by the Family health division. So coordination between these two divisions is very important to address the life cycle approach in nutrition.

Multi-sectoral coordination: Analysis of determinants of IDA, specially the low intake of iron in diet which is very important in the context of Nepal clearly shows that the problem of IDA is not only associated with the health sector. Types and quality of food cooked in the family and presence of iron in it associated with kind of grain produces by the HH are important. Similarly, the cultural practice of feeding habits among female and quality of food prepared (iron-rich) depends on the socio-economic level and level of awareness. Care of women during pregnancy and the lactating period, supplementation of iron, freedom from any kind of helminthic infestation, malaria, diarrhoea, etc. are associated with levels of knowledge on nutrition, sanitation and overall health services. All these are directly influenced by the amount of resources that country has, management of programs, political influence, and leadership. So there is need of integration of other sectors while planning and designing interventions because targeting only the health component won't give the desirable result.

The World Health Organization has recommended daily and weekly IFA supplementation to address the anaemia problem. Various studies showed that daily and weekly IFA supplementation can reduce IDA significantly and Nepal has been implementing daily IFA supplementation from many years focusing only on pregnant and lactating women. The weekly supplementation program which is tested and found good result in reducing anaemia should be implemented in Nepal among the adolescent girls whose prevalence for anaemia is higher than other reproductive age groups.

Similarly, it is observed that the government is focus more on short term strategy and has no national wide specific intervention related to long term strategy focus on food based strategy (diet diversification). This may be the reason of high IDA. Now there is a need for development of comprehensive and nutrition specific programs that address not only nutrition problem but also other factors which have direct links with nutrition.

CHAPTER V: CONCLUSION AND RECOMMENDATION

CONCLUSION

Iron Deficiency Anaemia is a serious public health problem in Nepal affecting mostly pregnant and lactating women and adolescents. The government response towards the vulnerable group is more focused on supplementation of iron with mass fortification, deworming, Vitamin A supplementation, control of malaria etc., which is a very good way to tackle the problem at the population level with instant good results on maternal and child health. IFA supplements have proven results on improvement in iron status also.

Though, the Government has interventions targeting most vulnerable groups among the reproductive age. Still there are few issues related to the current program intervention and prioritization of policy. The first issue is not covering all the vulnerable group of women. Adolescents are the most affected by the IDA problem among reproductive age groups but response towards them is lacking. Adolescents who are pregnant are covered by national IFA supplementation programs but adolescents who are not married are left out. There should be an initiative to address the adolescent IDA problem through evidenced based weekly IFA supplementation.

The second issue with the existing program is coverage and compliance of IFA supplementation and other related programs. The only direct intervention for the IDA program has comparatively low coverage and high compliance. Only around half of targeted women fulfill the recommended 180 and 45 IFA supplement. This may be due to the lack of awareness and education among the general and targeted population. Half of women population in the country is illiterate. In this situation awareness campaign related to the program play an important role. Similarly, coverage of other programs like deworming, Vitamin A supplementation, malaria control, family planning, diarrhoea control, ANC-PNC, treatment of common infection, etc. are also not as good as expected. The success and failure of these programs have direct impact on IDA and proper communication and co-ordination between different programs is needed. The coverage and consumption pattern of fortified flour is limited to certain populations.

The inadequate intake of iron in diet, which is the most important factor of IDA, should be addressed properly. This can be done through certain long term strategies like improved food security, diet modification/diversification, nutritional education, awareness on nutritive value of local foods etc. An awareness program is somehow touched by limited nutrition program but fully not covered. Dietary habit/pattern at the HH level plays an important

role in IDA. There is a need for change in food habits as well as cultural practices at the individual and community levels. Empowerment of women through education and knowledge can be helpful in improving cultural practices addressing gender issue. Food habit can be change by two ways. The first way is through creating knowledge, awareness and information of locally available iron-rich food and its importance on the body. For example, the locally prepared dry vegetable called "Gundruk" can be a good source of iron. People should be encouraged to consume locally available cereals like millets or buckwheat as an alternative to white rice. Soaking and malting before cooking can be done to increase bioavailability of iron in food. A food plan can be a good option incorporating locally available food rich in iron like Gundruk, black gram, etc. which helps in seasons when nutritious food is unavailable. The second way is the comprehensive way to improve nutritional status through integration of different sectors like education, agriculture, livestock, livelihood, etc. This type of intervention helps the HH to upgrade their living status which directly improves their nutritional status including their iron status. The government has started this approach in a few districts with different names like Suaahara, SABAL, Agriculture and food Security Project, etc.

RECOMMENDATION

The Iron Folic Acid (IFA) supplementation program which is one of the most important interventions to address IDA problem among pregnant and lactating women should be continued along with Maternal and Child Health and Nutrition supplementation programs targeted for food insecure districts. Awareness programs related to the need and importance of IFA supplementation should be increased massively at the community as well as the individual level so that compliance among beneficiaries is reduced.

Weekly Iron and Folic Acid supplementation programs which have sufficient evidence on reduction of IDA can be a good intervention for adolescents in Nepal who are more affected among reproductive age group and have no specific targeted intervention for them.

For the control of IDA, other factor like **Vitamin A supplementation**, deworming, family planning services, ANC-PNC check-ups, malaria control, chronic diarrhoea control, treatment of common infections, access and availability of health services, etc. which are the part of the health care system play an important role and should be improved.

Mass food fortification of wheat at national level with micronutrients like iron, Vitamin A and Folic Acid should be continued and promoted. Similarly

new innovative ways of small scale fortification at local and community level should be explored and promoted.

Nutrition education related to diet diversification, improving dietary intake, consumption of locally available iron-rich food, vegetables and fruits and foods that promote iron absorption should be promoted. In addition these programs also need to target certain cultural practice which hinders women access for nutritious food.

Food based strategies which are sustainable should be given more priority along with short term strategies like supplementation and should address comprehensive and multi-sectoral approaches including nutrition, agriculture, food security, livelihood, education etc. There should be timely evaluation of similar nature of project (Suaahara, SABAL, etc.) which are ongoing in the country and should be promoted and extended based on the evaluation results.

Nutritional interventions traditionally focus most on women of reproductive age and children under five which is good. However, to address the nutritional problem like IDA in a holistic way a comprehensive sustainable approach should be adopt incorporating a life cycle approach.

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ANNEXES:

Annex 1: Map of Nepal (Administrative Division)

Source: Topographical Survey Branch Survey Department Nepal. 2002

Annex 2: Organogram of Ministry of Health and population.

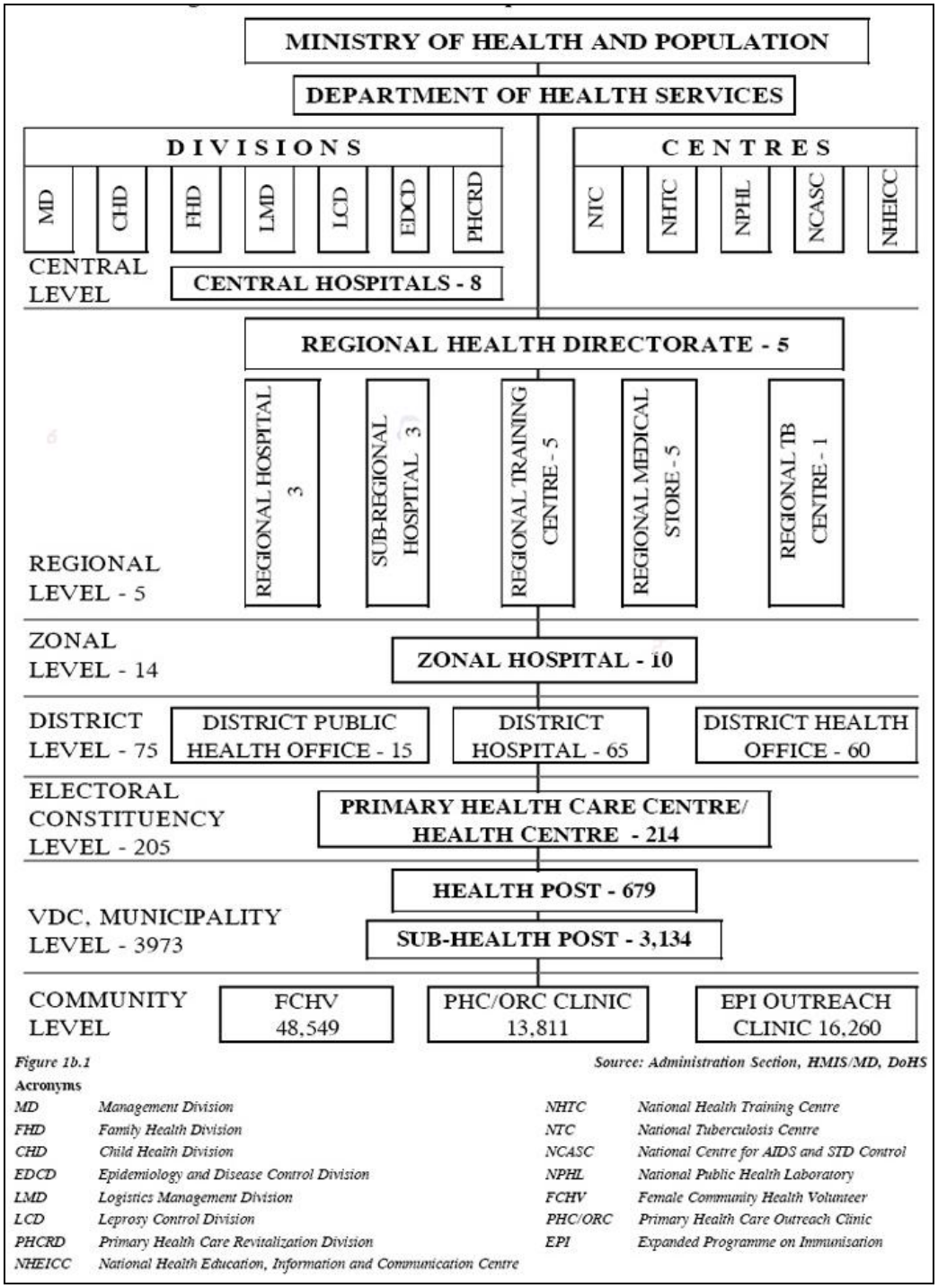

Figure 1b.1 *Source: Administration Section, HMIS/MD, DoHS*

Acronyms

MD	*Management Division*	*NHTC*	*National Health Training Centre*
FHD	*Family Health Division*	*NTC*	*National Tuberculosis Centre*
CHD	*Child Health Division*	*NCASC*	*National Centre for AIDS and STD Control*
EDCD	*Epidemiology and Disease Control Division*	*NPHL*	*National Public Health Laboratory*
LMD	*Logistics Management Division*	*FCHV*	*Female Community Health Volunteer*
LCD	*Leprosy Control Division*	*PHC/ORC*	*Primary Health Care Outreach Clinic*
PHCRD	*Primary Health Care Revitalization Division*	*EPI*	*Expanded Programme on Immunisation*
NHEICC	*National Health Education, Information and Communication Centre*		

Source: Annual Report 2014/15, Department of Health Service, MoHP

Annex 3: Classification of anaemia as a problem of public health significance

Severity of the public health problem	Prevalence of anaemia (% of the population)
None	≤4.9
Mild	5.0–19.9
Moderate	20.0–39.9
Severe	≥40

Source: Worldwide prevalence of anaemia 1993–2005: WHO global database on anaemia /Edited by Bruno de Benoist, Erin McLean, Ines Egli and Mary Cogs

Annex 4: Indicator for assessing Iron status at population Level.

Indicator	Sample	Population group	Cut-off to define deficiency		Comments
			Mild	Severe	
Haemoglobin[b]	Blood	Children 6–59 months	110 g/l	Not defined	Blood haemoglobin is primarily an indicator of anaemia but can provide useful information regarding iron status, as follows: — An increase of at least 10 g/l in blood haemoglobin after 1 or 2 months of iron supplementation is indicative of baseline iron deficiency. — Where poor availability of dietary iron is the main cause of anaemia, children and women have disproportionately low haemoglobin values, while those of adult men are virtually unaffected. Where other factors, such as parasites, contribute significantly, adult men are more likely to also have low haemoglobin values.
		Children 5–11 years	115 g/l		
		Children 12–14 years	120 g/l		
		Men over 15 years	130 g/l		
		Women over 15 years (non-pregnant)	120 g/l		
		Pregnant women	110 g/l	<70 g/l	
Ferritin	Serum or plasma	Under 5 years	<12 µg/l	Not defined	Useful indicator of iron status and also for monitoring interventions for iron deficiency.
		Over 5 years	<15 µg/l	Not defined	Reflects total body iron stores and is decreased in deficient subjects. Elevated in the presence of infection or inflammatory process and should thus be measured, if possible, in combination with another acute phase protein (CRP or AGP), which indicate the presence of infection. Levels of >200 µg/l in adult males (or 150 µg/l in adult females) indicates severe risk of iron overload.

Source: WHO 2004(Assessing the iron status of populations)

Annex 5: Global guidelines for the prevention of iron deficiency anemia in the public health context published since 2000

Intervention	Target population	Dose	Agency, year	Systematic review
Intermittent (weekly) iron supplementation	All menstruating adolescent girls and women where prevalence of anemia in this group is 20% or higher.	Iron: 60 mg of elemental iron Folic acid: 2800 μg (2.8 mg)	WHO, 2011[68]	Fernandez-Gaxiola and De-Regil 2011[30]
Intermittent (weekly) iron supplementation	Preschool and school-age children where prevalence of anemia in this group is 20% or higher.	Preschool: 25 mg elemental iron School age: 45 mg elemental iron	WHO, 2011[69]	De-Regil et al 2011[32]
Home fortification with multiple micronutrient powders	Children 6 to 23 mo old where the prevalence of anemia in this group is 20% or higher.	Iron: 12.5 mg elemental iron, preferably as ferrous fumarate Vitamin A: 300 μg retinol Zinc: 5 mg elemental zinc, preferably as zinc gluconate	WHO, 2011[48]	De-Regil et al 2011[70]
Home fortification with multiple micronutrient powders (not recommended)	Pregnant women	N/A	WHO, 2011[71]	Suchdev et al 2011[72]
Daily iron supplementation	All low-birth-weight infants Children 6 to 23 mo old where diet does not provide foods fortified with iron or where anemia prevalence is higher than 40% Children 2 to 5 y old, school-age children, women of childbearing age, pregnant women, and lactating women where anemia prevalence is higher than 40%	Low birth weight: elemental iron: 2 mg/kg/d from birth to 23 mo 6 to 23 mo: elemental iron: 2 mg/kg from 6 to 23 mo old 2 to 5 y: elemental iron: 2 mg/kg (maximum dose, 30 mg) for 3 mo School-age children: iron: 30 mg/d + folic acid: 250 μg/d for 3 mo Women of childbearing age: iron: 60 mg/d + folic acid: 400 μg/d for 3 mo Pregnant women: iron: 60 mg/d + folic acid: 400 μg/d for duration of pregnancy Lactating women: iron: 60 mg/d + folic acid: 400 μg/d for 3 mo post partum	WHO/UNU/UNICEF, 2001[2]	N/A
Optimization of food-based approaches to controlling anemia (ie, improvement of dietary diversity, changing meal patterns to ensure optimal iron absorption [minimize inhibitors and increase enhancers of iron absorption])	Community-wide	N/A	WHO/UNU/UNICEF, 2001[2]	N/A
Wheat and maize flour fortification	Consider when industrially produced wheat or maize flour is consumed by a large proportion of the population of the country	Fortification with iron, folic acid, zinc, B12, and vitamin A recommended; formulation and dose based on average per capita wheat flour availability	WHO, FAO, UNICEF, GAIN, MI, FFI, 2009[73]	N/A
Nutrient content of complementary foods in infants: meat, poultry, fish, or eggs should be eaten daily or as often as possible. Vegetarian diets cannot meet nutrient needs at this age unless nutrient supplements or fortified products are used.	Use fortified complementary foods as needed.	Not specified	PAHO[74]	N/A

Source: CDC, Centers for Disease Control and Prevention; FAO, Food and Agriculture Organization of the United Nations; FFI, Flour Fortification Initiative; GAIN, Global Alliance for Improved Nutrition; MI, Micronutrient Initiative; UNICEF, United Nations Children's Fund; WHO, World Health Organization; PAHO: Pan American Health Organization